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Renesas Technology Corp.
Customer Support Dept.
April 1, 2003

M306N4T-EPB
User's Manual

Emulation Probe
for
M16C/6N Group M16C/6N4, 5

First Edition: February 16, 2003

Mitsubishi Electric Corporation
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Preface

The M306N4T-EPB is an emulation probe for the M16C/6N Group M16C/6N4, 5 MCUs. The M306N4T-EPB is used by connecting to the PC7501 emulator main unit.

This user's manual mainly describes specifications of the M306N4T-EPB emulation probe and how to setup it. For details on the following products, which are used with the M306N4T-EPB, refer to each product's user's manual.

- Emulator: PC7501 User's Manual
- Emulator debugger: M3T-PD30F User's Manual

All the components of this product are shown in "Table 2.1 Package components" on page 20. If there is any question or doubt about this product, contact your local distributor.

To use the product properly

Precautions for Safety:

- In both this user's manual and on the product itself, several icons are used to insure proper handling of this product and also to prevent injuries to you or other persons, or damage to your properties.
- The icons' graphic images and meanings are given in "Chapter 1. Precautions for Safety" on page 7. Be sure to read this chapter before using the product.

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Terminology

Some specific words used in this user's manual are defined as follows:

PC7501 system

This means an emulator system built around the PC7501 emulator. The PC7501 emulator system is configured with an emulator main unit PC7501, emulation probe M306N4T-EPB, emulator debugger M3T-PD30F and host machine.

Emulator main unit PC7501

This means an emulator for the M16C Family MCUs. You can configure your emulator system by changing emulation probes according to your target MCU.

Emulation probe M306N4T-EPB

This means the emulation probe (this product) for the M16C/6N Group M16C/6N4, 5. It is used with the emulator main unit PC7501.

Emulator debugger M3T-PD30F

This means a software tool for the M16C/60 Series. You can control the emulator from a host machine through various interfaces.

Firmware

This means a program stored in the flash ROM of the emulator main unit PC7501. It analyzes contents of communication with the emulator debugger and controls the emulator PC7501. This program is downloadable from the emulator debugger to upgrade firmware or to support other MCUs.

Host machine

This means a personal computer used to control the PC7501 emulator system.

Target MCU

This means the microcomputer you are going to debug.

Target system

This means a user's application system using the microcomputer to be debugged.

User program

This means a user's application program to be debugged.

Evaluation MCU

This means a microcomputer mounted on the emulation probe which is operated in the special mode for the emulator.

*****

In this user's manual, this symbol is used to show active LOW. (e.g. RESET*)

Chapter 1. Precautions for Safety

This chapter describes precautions for using this product safely and properly. For precautions for the emulator main unit and the emulator debugger, refer to each user's manual included with your product.

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1.1 Safety Symbols and Meanings

In both the User's Manual and on the product itself, several icons are used to insure proper handling of this product and also to prevent injuries to you or other persons, or damage to your properties.

This chapter describes the precautions which should be taken in order to use this product safely and properly. Be sure to read this chapter before using this product.

⚠ **WARNING**	If the requirements shown in the "WARNING" sentences are ignored, the equipment may cause serious personal injury or death.
⚠ **CAUTION**	If the requirements shown in the "CAUTION" sentences are ignored, the equipment may malfunction.
IMPORTANT	It means important information on using this product.

In addition to the three above, the following are also used as appropriate.

△ means WARNING or CAUTION.

Example: **CAUTION AGAINST AN ELECTRIC SHOCK**

⃠ means PROHIBITION.

Example: **DISASSEMBLY PROHIBITED**

● means A FORCIBLE ACTION.

Example: **UNPLUG THE POWER CABLE FROM THE RECEPTACLE.**

The following pages describe the symbols "WARNING", "CAUTION", and "IMPORTANT".

⚠ WARNING

Warning for Installation:

- Do not set this product in water or areas of high humidity. Make sure that the main unit does not get wet. Spilling water or some other liquid into the main unit can cause an unrepairable damage.

Warnings for Use Environment:

- This equipment is to be used in an environment with a maximum ambient temperature of 35°C. Care should be taken that this temperature is not exceeded.

⚠ CAUTION

Caution to Be Taken for Modifying This Product:

- Do not modify this product. Modifying or disassembling this product will void your warranty.

Cautions to Be Taken for Turning On the Power:

- Turn on the power of the emulator and target system as simultaneously as possible.
- Turn off the power of the emulator and target system as simultaneously as possible.
- Do not leave either the emulator or target system powered on, because of leakage current the internal circuits may be damaged.
- When turning on the power again after shutting off the power, wait about 10 seconds.

Cautions to Be Taken for Handling This Product:

- Use caution when handling the main unit. Be careful not to apply a mechanical shock.
- Do not touch the connector pins of the emulator main unit and the target MCU connector pins. Static electricity may damage the internal circuits.
- Do not pull this product by the flexible cable for connecting to the emulator main unit and emulation probe. The cable may cause a break.
- Do not flex the flexible cable for connecting to the emulator main unit and emulation probe excessively. The cable may cause a break.
- Do not use inch-size screws for this equipment. The screws used in this equipment are all ISO (meter-size) type screws. When replacing screws, use same type screws as equipped before.

Caution to Be Taken for Malfunctions:

- If the emulator malfunctions because of interference like external noise, do the following to remedy the trouble.

  (1) Press the system reset switch on the emulator front panel.
  (2) If normal operation is not restored after step (1), shut OFF power to the emulator once and then reactivate it.

Caution to Be Taken for External Trigger Input Voltage:

- Keep an external trigger input voltage of the emulator main unit less than a Vcc voltage. Overvoltage may cause damage to the internal circuits.

IMPORTANT

Notes on Downloading Firmware:

- Before using this product for the first time, it is necessary to download the dedicated firmware. Please note that, to do this, it is necessary to start up the emulator main unit in maintenance mode. For downloading firmware, see "4.2 Downloading Firmware" on page 42. Once the firmware has been downloaded, the product can be used by simply turning on the power.
- Do not shut off the power while downloading the firmware. If this happens, the product will not start up properly. If the power is shut off unexpectedly, redownload the firmware.
- Download the firmware with the target system not connected.

Notes on Self-check:

- If the self-check does not result normally (excluding target system errors), the emulation probe may be damaged. Then contact your local distributor.
- Run the self-check with the target system not connected.

Note on Quitting the Emulator Debugger:

- To restart the emulator debugger, always shut power to the emulator module off once and then on again.

Note on Final Evaluation:

- Be sure to evaluate your system with an evaluation MCU. Before starting mask production, evaluate your system and make final confirmation with a CS (Commercial Sample) version MCU.

Notes on Power Supply to the Target System:

- Pin Vcc is connected in order to monitor target system voltage. For this reason, the emulator cannot supply power to the target system. Therefore, provide the target system with a separate power supply.
- The voltage of the target system should be as follows.

  $4.2\ V \leq Vcc \leq 5.5\ V$

Note on RESET* Input:

- A low input to pin RESET* from the target system is accepted only when a user program is being executed (when the RUN status LED on the PC7501's front panel is lit).

IMPORTANT

Note on NMI* Input:

- A low input to pin NMI* from the target system is accepted only when a user program is being executed (when the RUN status LED on the PC7501's front panel is lit).

Note on RDY* Input:

- Be sure to input a low to pin RDY* of the target system during the user program execution (only while the RUN status LED on the PC7501's upper panel is lit). Inputting a low signal to pin RDY* when the user program is stopped may cause a malfunction of the emulator.

Note on HOLD* Input:

- Be sure to input a low to pin HOLD* of the target system during the user program execution (only while the RUN status LED on the PC7501's upper panel is lit). Inputting a low signal to pin HOLD* when the user program is stopped may cause a malfunction of the emulator.

Notes on Maskable Interrupts:

- Even if a user program is not being executed (including when run-time debugging is being performed), the evaluation MCU keeps running so as to control the emulation probe. Therefore, timers and other components do not stop running.

  If a maskable interrupt is requested when the user program is not being executed (including when run-time debugging is being performed), the maskable interrupt request cannot be accepted, because the emulator disables interrupts. The interrupt request is accepted immediately after the user program execution is started.

- Take note that when the user program is not being executed (including when run-time debugging is being performed), a peripheral I/O interruption is not accepted.

Note on Clock Supply to the MCU:

- A clock supplied to the evaluation MCU is selected by the Emulator tab in the Init dialog box of the emulator debugger.

  (1) When "Internal" is selected:

  A clock generated by the oscillator circuit board in the PC7501 is supplied. It is continually supplied regardless of the status of the target system clock and that of the user program execution.

  (2) When "External" is selected:

  A clock generated by the oscillator in the target system is supplied. It depends on the status of the oscillation (on/off) of the target system.

  (3) When "Generate" is selected:

  A clock generated by the dedicated circuit in the PC7501 is supplied. It is continually supplied regardless of the status of the target system clock and that of the user program execution.

IMPORTANT

Note on Access Prohibited Area:

- You cannot use internally reserved areas. Write signals to the areas will be ignored, and values read will be undefined.

Notes on Stack Area:

- With this product, a maximum 8 bytes of the user stack is consumed as a work area.

  Even if the user stack does not have an enough area, do not use areas which cannot be used as a stack (SFR area, RAM area which stores data, or ROM area) as a work area. Using areas like this is a cause of user program crashes and destabilized emulator control.

- With this product, the interrupt stack pointer (ISP) is set at 00500h and used as a stack area after a reset is released.

Notes on Reset Vector Area:

- Memory in the emulator main unit is always selected as a reset vector area (FFFFCh--FFFFFh) in order to operate the evaluation MCU in the emulator-dedicated mode. Set the contents of the reset vector area in one of the following ways.

  (1) Download a user program to an area including the reset vector area.
  (2) Set the reset vector using a dump window of the emulator debugger etc.

- You can change data in the reset vector area only when the user program is stopped.

- Do not access the reset vector area as data. It may not be accessed properly, and the program may not run properly in the next bus cycle.

Note on Accessing Address 00000h:

- With the M16C/60 Series MCUs, when a maskable interrupt is generated, the interrupt data (interrupt number and interrupt request level) stored in address 00000h is read out. Also, the interrupt request bit is cleared when address 00000h is read out. Consequently, when the address 00000h readout instruction is executed or when address 00000h is read out in the cause of a program runaway, a malfunction occurs in that the interrupt is not executed despite the interrupt request, because the request bit of the highest priority interrupt factor enabled is cleared.

  For this malfunction, when the reading out to address 00000h is generated excluding the interrupt, the WARNING LED (yellow) lights up to alarm. When this LED lights, there is a possibility of wrong access, therefore check the user program.

Note on Stop and Wait Modes:

- Do not single step an instruction shifting to stop or wait mode. It may cause communication errors.

IMPORTANT

Note on Display of MCU Status:

- "MCU status" you can refer to in the MCU tab of the MCU Setting dialog box of the emulator debugger shows pin levels of the target system. Make sure that proper pin levels are specified according to the mode you use.

  (1) When single-chip mode is used:
  CNVss: Low

  (2) When memory expansion mode 16-bit data bus width is used:
  CNVss: Low, BYTE: Low, HOLD*: High, RDY*: High

  (3) When memory expansion mode 8-bit data bus width is used:
  CNVss: Low, BYTE: High, HOLD*: High, RDY*: High

  (4) When microprocessor mode 16-bit data bus width is used:
  CNVss: High, BYTE: Low, HOLD*: High, RDY*: High

  (5) When microprocessor mode 8-bit data bus width is used:
  CNVss: High, BYTE: High, HOLD*: High, RDY*: High

Note on Breaks:

- The area displaying break points in the program window of the emulator debugger shows the following breaks.

  (1) Address-match break "A"

  This is a debugging function which breaks a program, using the address-match interrupt function of the MCU, immediately before the system executes an instruction at a specified address. The instruction at the preset address will not be executed.

  (2) Software break "B"

  This is a debugging function which generates a BRK interruption by changing an instruction at a specified address to a BRK instruction (00h) to break a program immediately before the system executes an instruction at a specified address. The instruction at the preset address will not be executed.

  (3) Hardware break "H"

  This is a debugging function which breaks a program by setting the detection of an execution of an instruction at a specified address as a break event. The program will break after the instruction at the specified address is executed.

Notes on Address-Match Breaks:

- As the processing speed of setting and canceling address-match breaks is relatively fast, you can save the times of writing into the internal flash ROM of the MCU. Therefore, address-match breaks precede the other breaks when setting breakpoints in the internal flash ROM area of the MCU.
- Address-match breaks can be set only in RAM and ROM areas of the MCU.
- Address-match breaks can be set at up to four points. The other breaks are set as software breaks.
- Address-match breaks can be set or canceled even when the user program is being executed.

IMPORTANT

Notes on Address-Match Interrupts:

- When you use the address-match interrupt function in a user program, uncheck "Enable the Address Match Interrupt Break Function" in the MCU tab of the Init dialog box of the emulator debugger. Thus, normal software breaks are used for the internal RAM and ROM areas of the MCU.
- Do not set a software break at an address where an address-match interrupt occurs. Otherwise, a user program may be run out of control. Set a software or hardware break in the top address in address-match interrupt processing.
- When you single step an address where an address-match interrupt occurs, the program stops after executing the first instruction after returning from address-match interrupt processing.

Note on Software Breaks:

- Software breaks change the instruction at a specified address to a BRK (00h). Therefore, take note that when you reference the result of a trace in bus mode, "00h" is displayed.
- The BRK instruction can be used for the emulator only. You cannot use it in a user program.
- You can neither set nor cancel a software breakpoint in the internal ROM area of the MCU during user program execution, while you can set or cancel it in the internal RAM area of the MCU and the area (emulation memory) where the map setting is INTERNAL in chip-select CS3* to CS0*.

IMPORTANT

Note on Differences between the Actual MCU and Emulator:

- Operations of the emulator system differ from those of actual MCUs as listed below.

  (1) Reset condition

  (2) Initial values of internal resource data of the MCU at power-on

  (3) Interrupt stack pointer (ISP) after a reset is released

  (4) Capacities of the internal memories (ROM and RAM)

  The evaluation MCU of this product has RAM of 31 KB (00400h--07FFFh) and flash ROM of 4 KB (0F000h--0FFFFh) and 384 KB (A0000h--FFFFFh).

  (5) Oscillator circuit

  In the oscillator circuit where an oscillator is connected between pins Xin and Xout, oscillation does not occur because a converter board is used between the evaluation MCU and the target system. It is same for pins Xcin and Xcout. For notes on when using the oscillator circuit on the target system, refer to "3.1.3 Using the Oscillator Circuit on the Target System" on page 29.

  (6) A-D conversion

  The characteristics of the A-D converter differ from those of actual MCU because there are a converter board and other devices between the evaluation MCU and the target system.

  (7) Ports P0 to P5, P10

  This product emulates some I/O ports (P0 to P5, P10). Therefore, the electrical characteristics of these ports differ from those of the actual MCU.

  (8) Address and status of BHE*

  When the internal RAM or ROM area of the MCU is accessed during user program execution, actual MCUs retain a preceding address and status of BHE*, while this product does not.

  (9) Status of a data bus

  In stop or wait mode, actual MCUs retain a preceding status of a data bus, while with this product a data bus is floating.

Note on Watchdog Function:

- If the reset circuit of the target system has a watchdog timer, disable it when using the emulator.

Note on DMA Transfer:

- With this product, the program is stopped with a loop program to a specific address. Therefore, if a DMA request is generated while the program is stopped, DMA transfer is executed. However, make note that DMA transfer while the program is stopped may not be performed correctly. Also note that the below registers have been changed to generate DMA transfer as explained here even when the program is stopped.

  (1) DMA0 transfer counter: TCR0
  (2) DMA1 transfer counter: TCR1

IMPORTANT

Note on Protect Register:

- The protect is not canceled when bit 2 of protect register PRCR (PRC2), which enables writing into the port P7, P9 direction registers and the SI/Oi control register, is changed with the below procedure.

  (1) Step execution of an instruction setting PRC2 to "1"

  (2) Setting a break point between an instruction setting PRC2 to "1" and a point where the port P9 direction register or the SI/Oi control register is set

  (3) Setting PRC2 to "1" by the dump window or script window

Notes on Pullup Control:

- Because this product emulates some I/O ports (P0 to P5, P10), you can not pullup ports P0 to P5 by the pullup control registers. Install the included resistor arrays (51 kΩ) as necessary.
- The initial value of pullup control register 1 PUR1 of this product is different from that of the actual MCU. When a Vcc level is input to pin CNVss, the value of the actual MCU is "02h" (bit 1 PU11 is "1"), while that of this product is "00h".

Note on Operating Frequency:

- You can not use this product with a main clock (Xin-Xout) less than 1 MHz. To use it with a main clock less than 1 MHz, contact your local distributor.

Notes on Internal Flash ROM of the MCU:

- This product downloads a user program to the flash ROM in the MCU when debugging in single-chip or memory expansion mode. By checking "Disable the Internal Flash ROM" in the MCU tab of the MCU setting dialog box of the emulator debugger, you can disable the operation of the internal flash ROM of the MCU to use the emulation memory. However, the maximum operating frequency is 10 MHz.
- Because the number of write/erase cycles of the internal flash ROM of the MCU is limited, it must be replaced at the end of its service-life.
- If the following errors occur frequently when downloading a program, replace the MCU board.

  (1) Flash ROM erase error occurred ERROR (16258)
  (2) Flash ROM verify error occurred ERROR (16259)

  To purchase products for replacement, contact your local distributor.

IMPORTANT

Notes on Debugging in CPU Rewrite Mode:

- When you debug an M16C/6N4, 5 MCU of the M16C/6N group in CPU rewrite mode, do not change the block 0 area (FF000h--FFFFFh) of the flash memory. Otherwise, the emulator will be uncontrollable.
- If you check "Debug the program using CPU Rewrite Mode" in the MCU tab of the Init dialog box of the emulator debugger, you cannot use the following functions.

  (1) Setting software breakpoints in an internal ROM area
  (2) Executing COME in an internal ROM area
- In the rewrite control program area (from setting CPU rewrite mode to releasing it), do not use the following functions.

  (1) Single-stepping
  (2) Setting software breakpoints
  (3) Setting hardware breakpoints
- To reference data after executing CPU rewrite, stop the program at a point which is not a rewrite control program area and use a dump window etc.

Chapter 2. Preparation

This chapter describes the package components, the system configuration and the preparation for using this product for the first time.

2.1 Package Components 20
2.2 Other Tool Products Required for Development 20
2.3 Name of Each Part 21
2.3.1 System Configuration 21
2.3.2 Names and Functions of the PC7501 Upper Panel LEDs 21
2.4 When Using the Emulator for the First Time 24
2.4.1 Downloading Firmware 24
2.4.2 Self-check 24

2.1 Package Components

The M306N4T-EPB package consists of the following items. When unpacking it, check to see if your M306N4T-EPB contains all of these items.

Table 2.1 Package components

Item	Quantity
M306N4T-EPB emulation probe	1
M30800T-PTC converter board for 100-pin 0.65-mm-pitch LCC (Pre-attached)	1
IC61-1004-051 LCC socket (100-pin 0.65-mm-pitch) made by Yamaichi Electronics Co., Ltd.	1
OSC-3 (16 MHz) oscillator circuit board	1
OSC-2 oscillator circuit bare board	1
Resistor arrays (51 kΩ) for ports P0 to P5 pullup	6
Hardware tool user registration FAX sheet	1
Hardware tool user registration FAX sheet (Japanese)	1
M306N4T-EPB user's manual (this manual)	1
M306N4T-EPB user's manual (Japanese)	1

* Please keep the M306N4T-EPB's packing box and cushion material in your place for reuse at a later time when sending your product for repair or other purposes. Always use these packing box and cushion material when transporting this product.
* If any of these items are missing or found faulty, please contact your local distributor.
* If there is any question or doubt about the packaged product, contact your local distributor.
* For purchasing the IC61-1004-051 or for technical information, contact Yamaichi Electronics Co., Ltd.
  http://www.yamaichi.co.jp/e/index.shtml

2.2 Other Tool Products Required for Development

To bring forward programs development on an M16C/6N4, 5 MCU of the M16C/6N Group, the products listed below are necessary in addition to those contained package above. Get them separately.

Table 2.2 Other tool products required for development

<table>
<tr><th colspan="2">Product</th><th>Product name</th><th>Notes</th></tr>
<tr><td colspan="2">Emulator main unit</td><td>PC7501</td><td>Required</td></tr>
<tr><td colspan="2">Emulator debugger</td><td>M3T-PD30F</td><td>Required</td></tr>
<tr><td rowspan="3">Converter boards</td><td rowspan="3">100-pin 0.65-mm-pitch QFP
(100P6S-A)</td><td>M3T-100LCC-DMS
+
M3T-DIRECT100S</td><td rowspan="3">Required according to a foot pattern of a target system</td></tr>
<tr><td>M3T-100LCC-DMS
+
M3T-DUMMY100S</td></tr>
<tr><td>M3T-100LCC-DMS
+
M3T-FLX-100NRB</td></tr>
</table>

* For purchasing these products, please contact your local distributor.

2.3 Name of Each Part

2.3.1 System Configuration

Figure 2.1 shows a configuration of the PC7501 system.

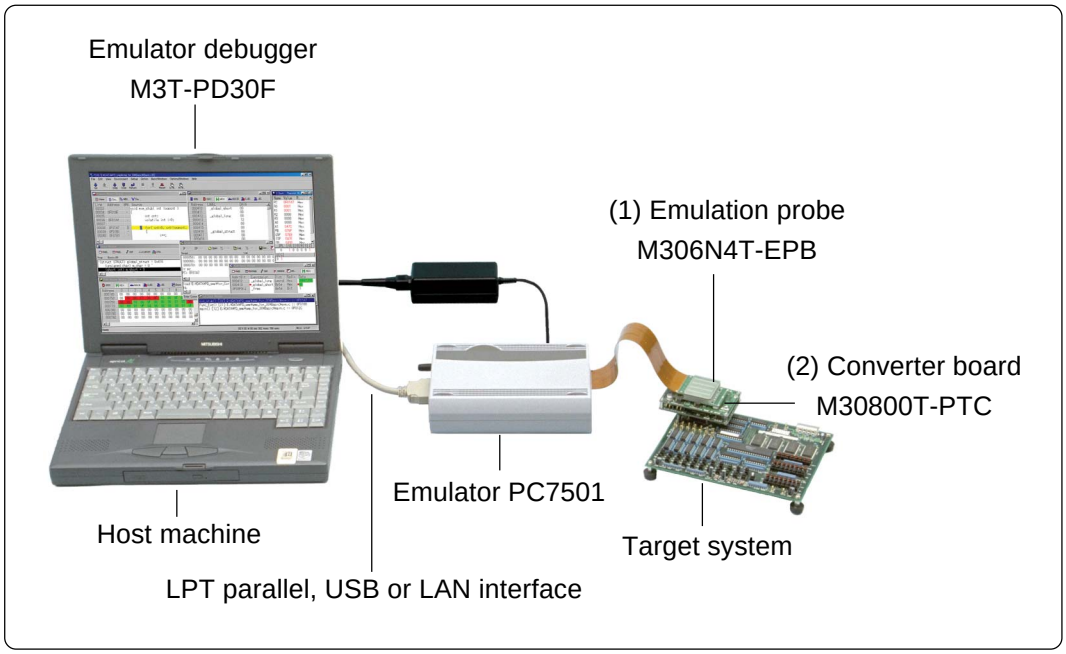

Figure 2.1 System configuration

(1) Emulation probe M306N4T-EPB

This emulation probe consists of interface board PCA7501EPBA for the M16C/60 Series and MCU board M306N4T-EPBM for the M16C/6N4. The M306N4T-EPBM with an evaluation MCU is separately available for replacement.

(2) Converter board M30800T-PTC

This is a converter board for connecting to 100-pin 0.65-mm-pitch LCC socket IC61-1004-051 on the target system. For details, refer to "3.6 Connecting the Target System" on page 34.

2.3.2 Names and Functions of the PC7501 Upper Panel LEDs

Figure 2.2 shows the names of the LEDs on the upper panel of the PC7501.

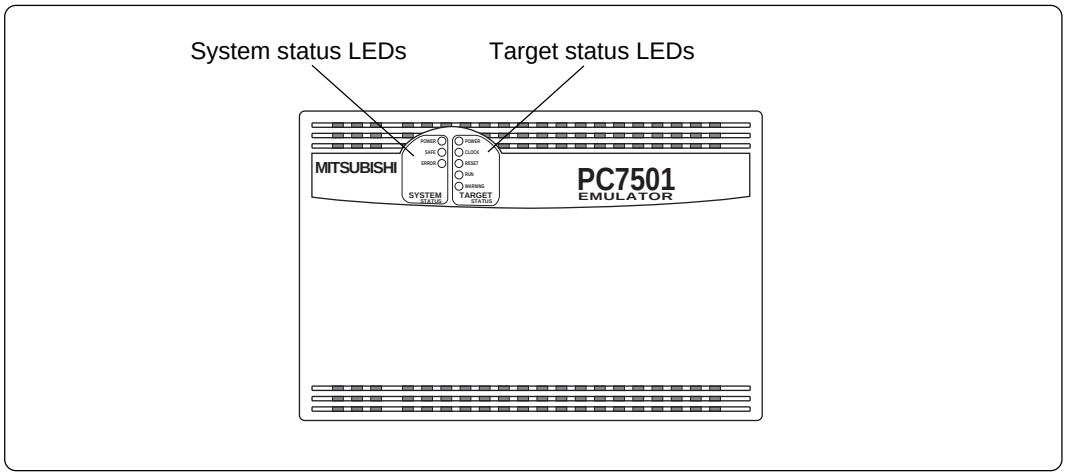

Figure 2.2 Names of the LEDs on the upper panel of the PC7501

(1) System Status LEDs

The system status LEDs indicate the emulator PC7501's power supply, firmware operating status, etc. Table 2.3 lists the definition of each system status LED.

Table 2.3 Definition of the system status LEDs

Name	Status	Meaning
POWER	ON	PC7501 system is turned ON.
	OFF	PC7501 system is turned OFF.
SAFE	ON	PC7501 system is operating normally.
	Flashing	1. The self-check is being executed. 2. Downloaded firmware is being written into memory. 3. If the ERROR LED is flashing or turned on at the same time, the self-check cannot be executed because of malfunction of the target system.
	OFF	PC7501 system is not operating normally (system status error).
ERROR	ON	PC7501 system is not operating normally (system status error).
	Flashing	1. Firmware is being downloaded. 2. If the SAFE LED is flashing at the same time or alternately, the self-check cannot be executed because of malfunction of the target system.
	OFF	PC7501 system is operating normally.

(2) Target Status LEDs

The target status LEDs indicate operating status of the target MCU and power supply of the target system. Table 2.4 lists the definition of each target status LED.

Table 2.4 Definition of the target status LEDs

Name	Status	Meaning
POWER	ON	Power is supplied to the target system.
	OFF	Power is not supplied to the target system.
CLOCK	ON	Target MCU clock is oscillating.
	OFF	Target MCU clock is not oscillating.
RESET	ON	Target MCU is being reset.
	OFF	Target MCU is not being reset.
RUN	ON	User program is being executed.
	OFF	User program has been halted.
WARNING	ON	Address 00000h has been read out.
	OFF	Address 00000h has not been read out.

⚠CAUTION

Note on Usage in Memory Expansion or Microprocessor Mode:

- When you use this product in memory expansion or microprocessor mode, be sure to design your system so that pins RDY* and HOLD* are not active at startup. Otherwise, it cannot startup normally.

Note on the Target Status POWER LED:

- If your MCU has two or more Vcc terminals, the LED does not light unless power is supplied to all the terminals.

Note on the Target Status CLOCK LED:

- If the LED is not turned on, check the following.

(1) After powering on the PC7501 (before starting up the emulator debugger):

Make sure that the oscillator circuit board is properly installed in the PC7501 and it is oscillating normally.

(2) After the emulator debugger is started up (after the Init dialog box settings are completed):

Make sure that the oscillator selected in the Init dialog box is oscillating normally.

Note on Accessing Address 00000h:

- With the M16C/60 Series MCUs, when a maskable interrupt is generated, the interrupt data (interrupt number and interrupt request level) stored in address 00000h is read out. Also, the interrupt request bit is cleared when address 00000h is read out. Consequently, when the address 00000h readout instruction is executed or when address 00000h is read out in the cause of a program runaway, a malfunction occurs in that the interrupt is not executed despite the interrupt request, because the request bit of the highest priority interrupt factor enabled is cleared.

  For this malfunction, when the reading out to address 00000h is generated excluding the interrupt, the WARNING LED (yellow) lights up to alarm. When this LED lights, there is a possibility of wrong access, therefore check the user program.

2.4 When Using the Emulator for the First Time

2.4.1 Downloading Firmware

If you have purchased this emulation probe newly, you need to download the firmware. The download procedure is given in Figure 2.3.

Before downloading the firmware, check that emulator debugger M3T-PD30F is installed to your host machine and the PC7501 is connected to the host machine. For more details, see each user's manual of emulator debugger M3T-PD30F and the PC7501.

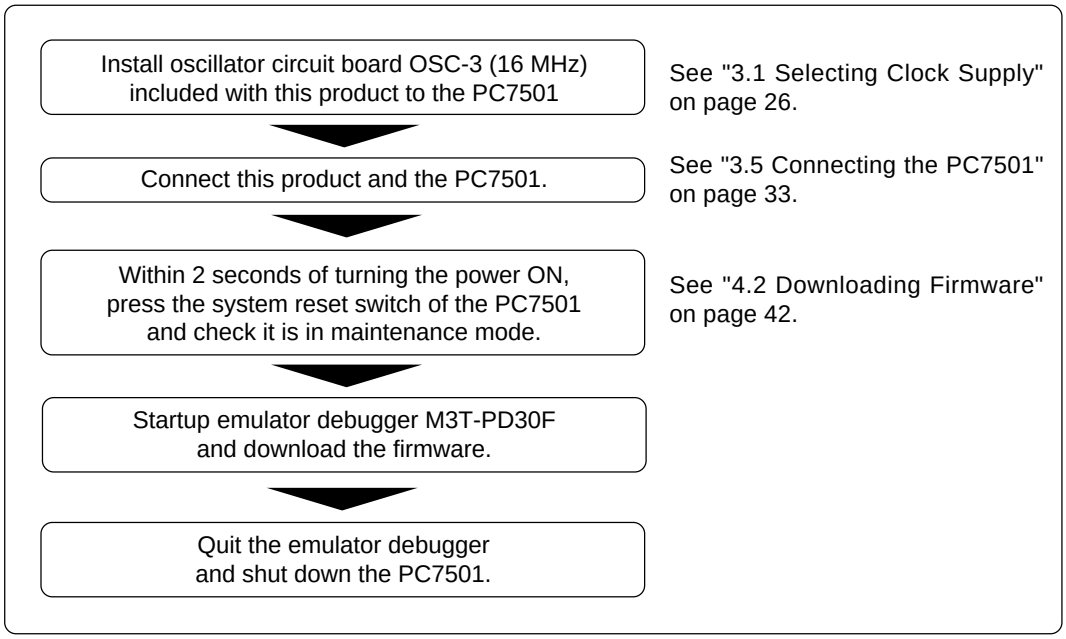
Install oscillator circuit board OSC-3 (16 MHz) included with this product to the PC7501
See "3.1 Selecting Clock Supply" on page 26.
Connect this product and the PC7501.
See "3.5 Connecting the PC7501" on page 33.
Within 2 seconds of turning the power ON, press the system reset switch of the PC7501 and check it is in maintenance mode.
See "4.2 Downloading Firmware" on page 42.
Startup emulator debugger M3T-PD30F and download the firmware.
Quit the emulator debugger and shut down the PC7501.

Figure 2.3 Firmware download procedure

2.4.2 Self-check

Execute the self-check after downloading the firmware to check that the emulation probe operates properly. Figure 2.4 shows the self-check procedure.

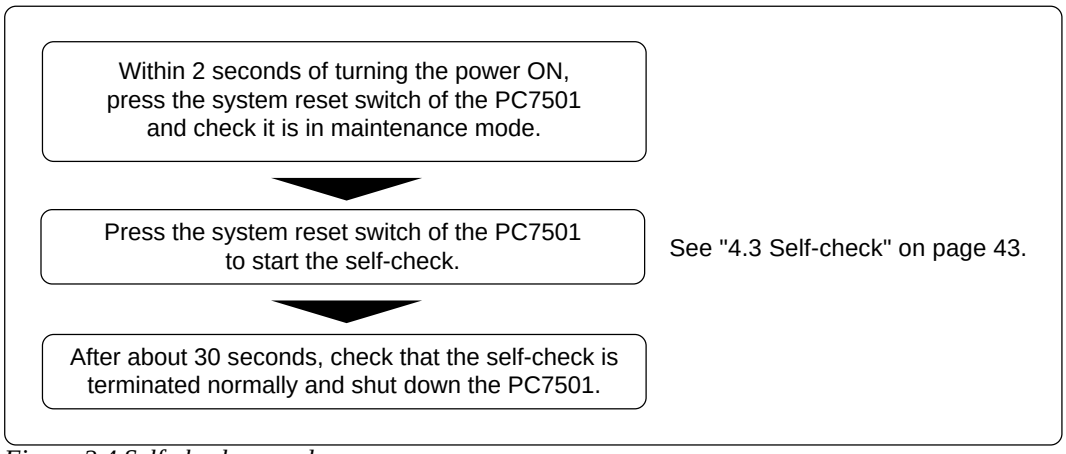
Within 2 seconds of turning the power ON, press the system reset switch of the PC7501 and check it is in maintenance mode.
Press the system reset switch of the PC7501 to start the self-check.
See "4.3 Self-check" on page 43.
After about 30 seconds, check that the self-check is terminated normally and shut down the PC7501.

Figure 2.4 Self-check procedure

Chapter 3. Setup

This chapter describes switch settings required for using this product and how to connect this product to the PC7501 and the target system.

3.1 Selecting Clock Supply 26
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3.1 Selecting Clock Supply

3.1.1 Clocks

You can choose a clock supplied to the evaluation MCU by the Emulator tab in the Init dialog box of the emulator debugger. Table 3.1 shows the clocks and their initial settings.

Table 3.1 Clock supply to the MCU

Clock	Display of emulator debugger	Description	Default setting
Main (Xin-Xout)	Internal	Internal oscillator circuit board (OSC-3 or OSC-2)	Yes
	External	Oscillator circuit on the target system	-
	Generate	Internal generator circuit (1.0--16.0 MHz)	-
Sub (Xcin-Xcout)	Internal	Internal oscillator circuit (32.768 kHz)	-
	External	Oscillator circuit on the target system	Yes

3.1.2 Using an Internal Oscillator Circuit Board

(1) Kinds of Oscillator Boards

The PC7501 comes with an oscillator circuit board OSC-3 (30 MHz). And an oscillator circuit board OSC-3 (16 MHz) and a oscillator circuit bare board OSC-2 are included with this product. If you use an internal oscillator circuit board of the PC7501 as a main clock, choose "Internal" in the emulator debugger after replacing oscillator circuit boards to change a clock supplied to the MCU.

(2) Replacing an Oscillator Circuit Board

1. Remove the four screws of both sides of this product and lift off the upper cover (see Figure 3.1).

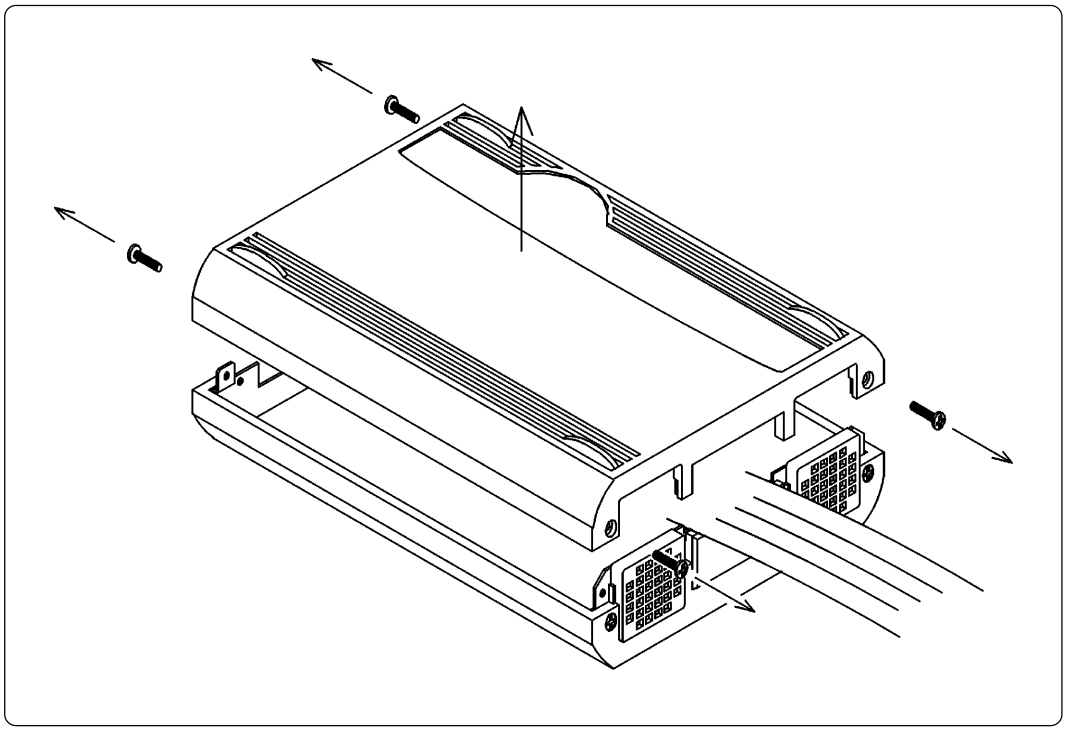
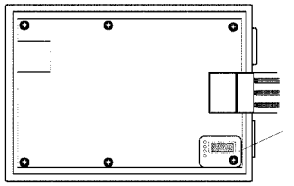


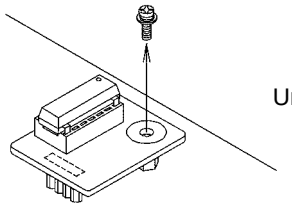
Figure 3.1 Removing the upper cover

2. Replace the oscillator circuit board (see Figure 3.2).

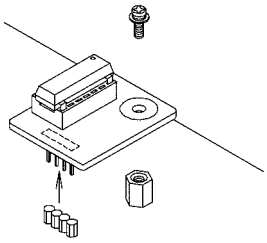


The oscillator circuit board of the PC7501 is in the lower right corner of the board.

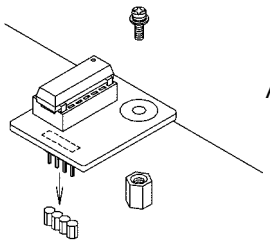
Oscillator circuit board



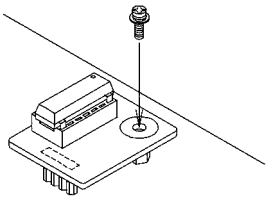
Unscrew the screw securing the oscillator circuit board.



Lift off the oscillator circuit board.



Attach another oscillator circuit board to the connector.



Secure the new oscillator circuit board with the screw.

Figure 3.2 Replacing the oscillator circuit board

3. Reinstall the upper cover and secure the four screws.

⚠ CAUTION

Note on Replacing the Oscillator Circuit Board:

- Always shut OFF power when removing the upper cover or replacing oscillator circuit board. Otherwise, internal circuits may be damaged.

(3) Using the Internal Oscillator Circuit Bare Board

To use the emulation probe at a frequency you like, build a desired oscillator circuit on the included OSC-2 oscillator circuit bare board.

Figure 3.3 shows an external view of the OSC-2 oscillator circuit bare board and where the connector pins are located. Figure 3.4 shows the circuitry of oscillator circuit bare board OSC-2. Use the number of oscillator circuits recommended by the oscillator manufacturer.

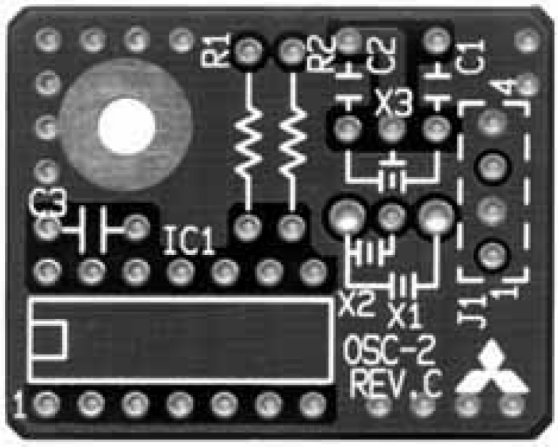


Figure 3.3 External view of oscillator circuit board OSC-2 and its connector pin positions

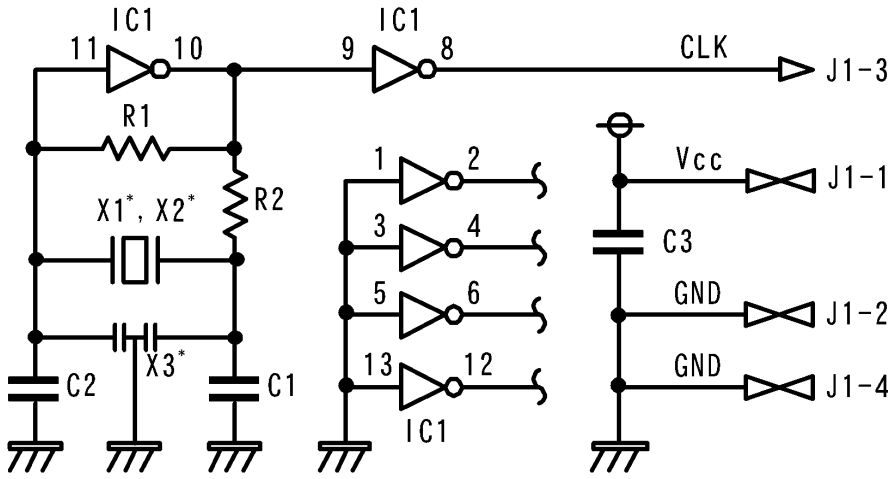


Figure 3.4 Circuits of oscillator circuit bare board OSC-2

3.1.3 Using the Oscillator Circuit on the Target System

To operate this product with an external clock, construct the oscillator circuit as shown in Figure 3.5 in the target system and input the oscillator output at 50% duty (within the operating range of the evaluation MCU) into pin Xin. And pin Xout should be open. Choose "External" in the emulator debugger to use this clock.

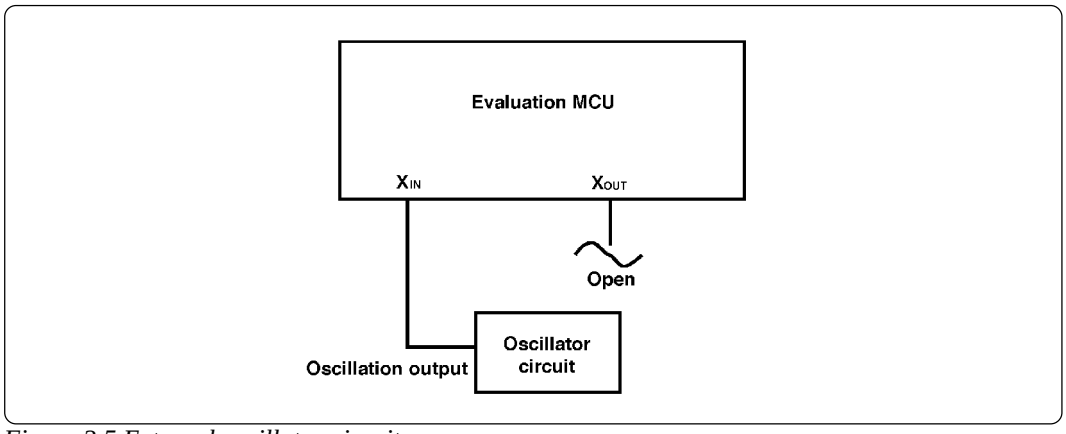


Figure 3.5 External oscillator circuit

Make note that in the oscillator circuit shown in Figure 3.6 where a resonator is connected between pins Xin and Xout, oscillation does not occur because a converter board and other devices are used between the evaluation MCU and the target system. It is same for sub-clock oscillator circuits (Xcin and Xcout).

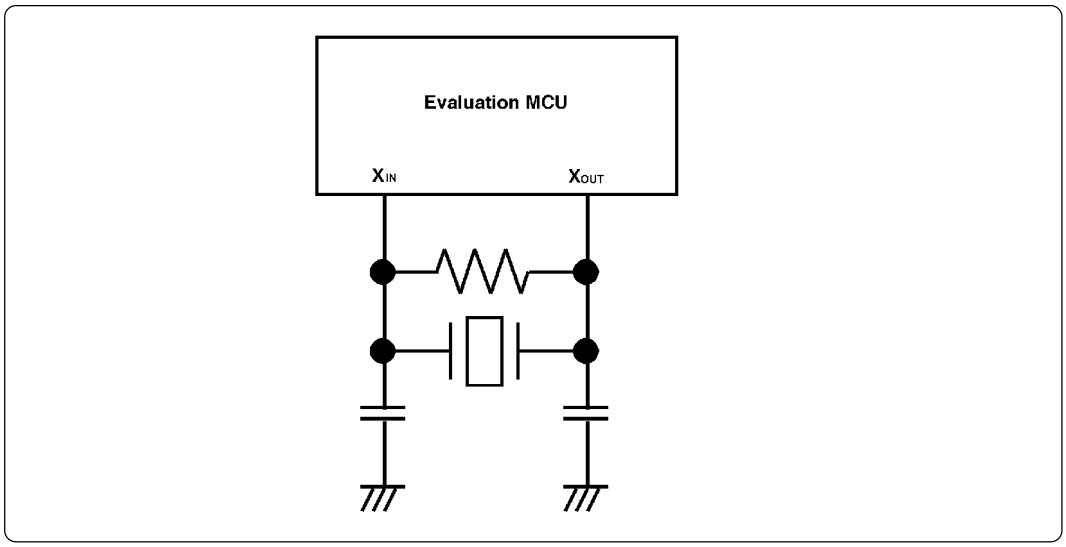


Figure 3.6 Circuit in which oscillation does not occur

3.1.4 Using the Internal Generator Circuit

The dedicated circuit in the PC7501 can generate any arbitrary frequency specified by the emulator debugger, and it can be supplied as a main clock. It does not depend on either the oscillator circuit board in the PC7501 or the oscillator circuit on the target system. If you want to debug programs without the target system or change a frequency temporarily, you can check its operation before purchasing an oscillator. If you want to use the internal generator circuit in the PC7501 as a main clock, choose "Generate" in the emulator debugger and specify a frequency you like to use this clock.

Although you can change a frequency between 1.0 and 99.9 MHz by 0.1 MHz for the PC7501, do not specify a value exceeding the maximum input frequency of the Xin of the MCU.

IMPORTANT

Note on Using the Internal Generator Circuit:

- The internal generator circuit is equipped for temporary debugging purposes. Temperature characteristics of frequencies are not guaranteed.

3.2 Switch Settings

Set jumper switch JP1 according to a power supply you use. Figure 3.7 shows the positions of jumper switch JP1. Table 3.2 lists how to set the switch.

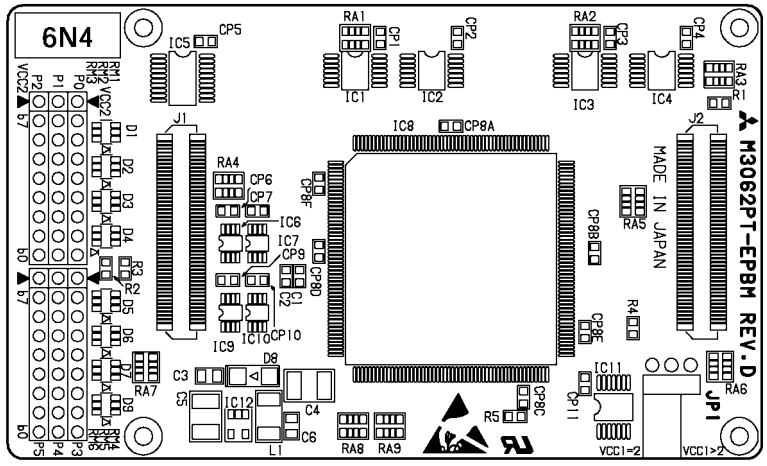


Figure 3.7 Position of the JP1

Table 3.2 Switch settings of the JP1

Switch	Setting	Voltage
JP1	VCC1 = 2 VCC1 > 2 (Factory-setting)	4.2 V ≤ Vcc ≤ 5.5 V

3.3 A-D Conversion Bypass Capacitors

There is a foot pattern on the M306N4T-EPBM board for mounting bypass capacitors for the A-D conversion circuit near the MCU. Mount suitable bypass capacitors as occasion demands. Figure 3.8 shows where they are installed and the configuration of this product.

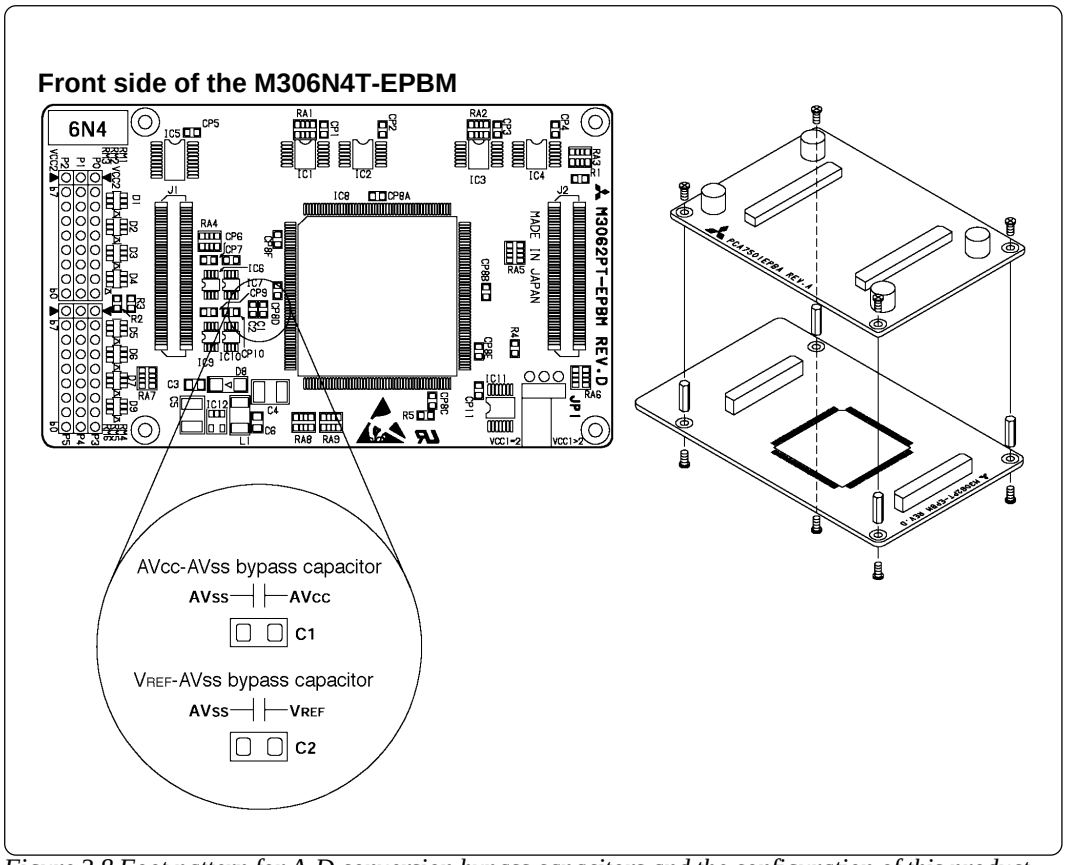


Figure 3.8 Foot pattern for A-D conversion bypass capacitors and the configuration of this product

IMPORTANT

Note on the A-D Converter Function:

- Because a converter board and other devices are used between the evaluation MCU and the target system, the A-D converter operates differently from that of the actual MCU. Make the final evaluation of the A-D converter with the actual MCU.

3.4 Emulation Port Pullup

Because this product emulates some I/O ports (P0 to P5, P10), you can not pullup ports P0 to P5 by the pullup control registers. Install the included resistor arrays (51 kΩ) as necessary. Figure 3.9 shows the positions of the pullup resistors. And, Table 3.2 lists the emulation port numbers and the pullup resistor part numbers.

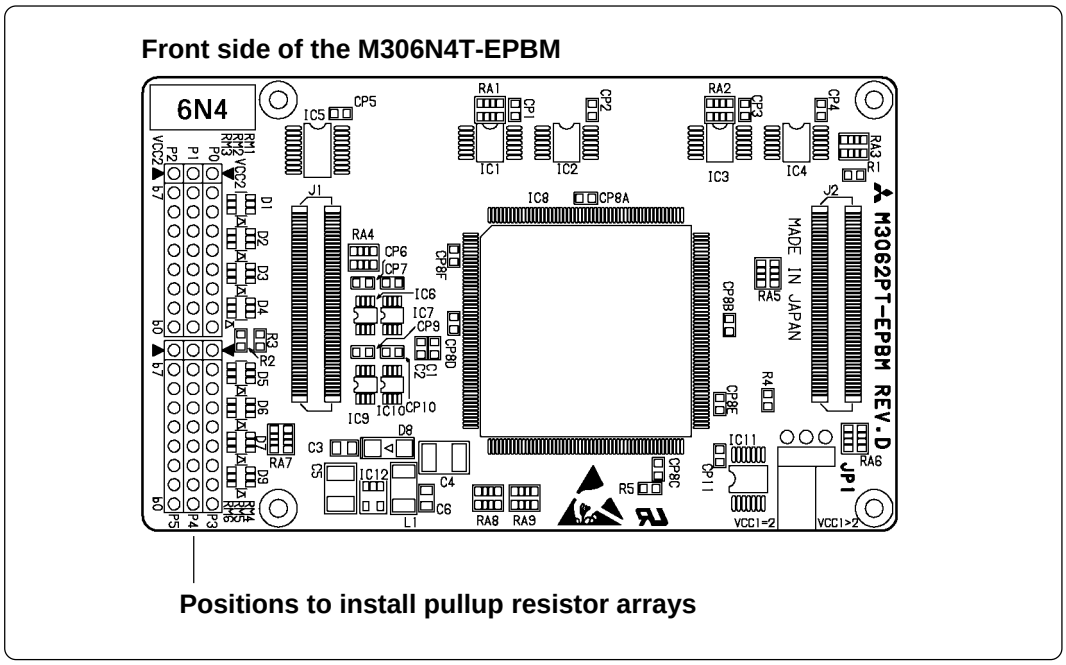


Figure 3.9 Positions of the pullup resistors

Table 3.3 Emulation ports and pullup resistor part numbers

Port	Resistor part
P00--P07	RM1 (51 kΩ pullup)
P10--P17	RM2 (51 kΩ pullup)
P20--P27	RM3 (51 kΩ pullup)
P30--P37	RM4 (51 kΩ pullup)
P40--P47	RM5 (51 kΩ pullup)
P50--P57	RM6 (51 kΩ pullup)

3.5 Connecting the PC7501

Figure 3.10 shows how to connect the PC7501 and the emulation probe.

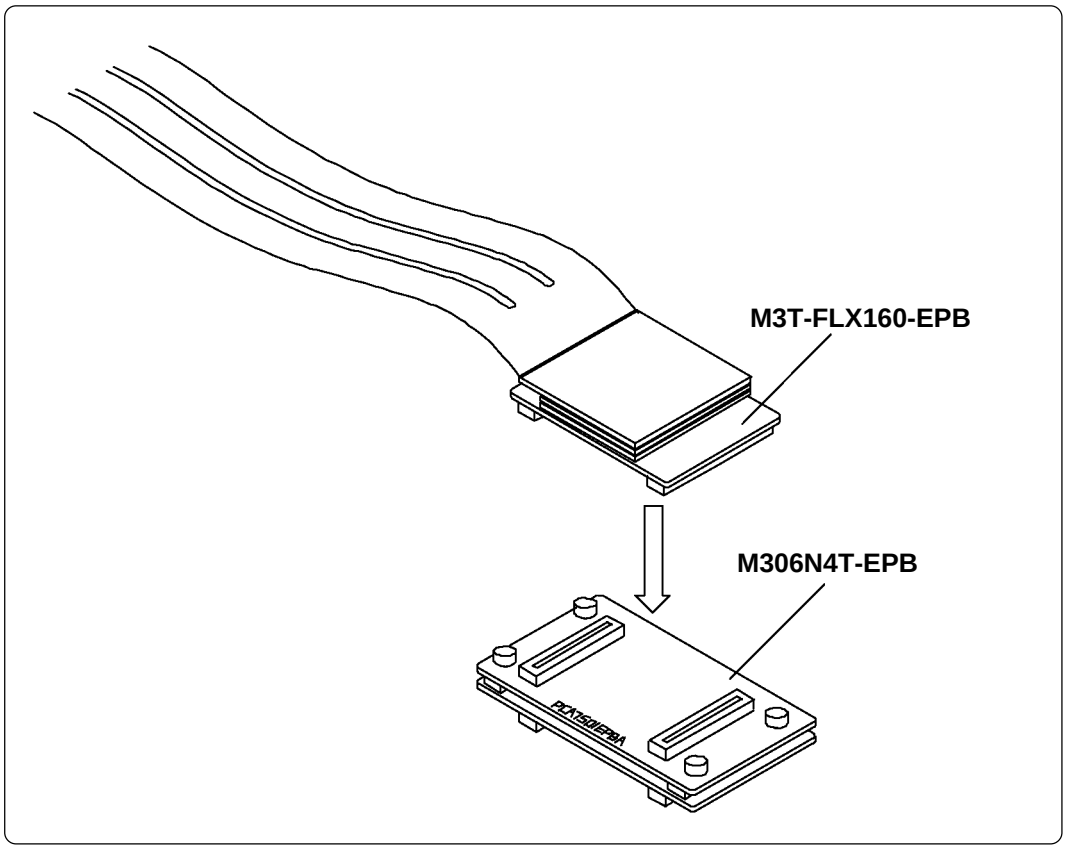


Figure 3.10 Connecting the PC7501 and the emulation probe

⚠ CAUTION

Note on Connecting the PC7501:

- When connecting the emulation probe, be sure to hold the both sides of the emulation probe horizontally and insert it directly.
- Always shut OFF power before connecting the emulation probe. Otherwise, internal circuits may be damaged.

3.6 Connecting the Target System

Figure 3.11 shows how to connect this product according to your target system.

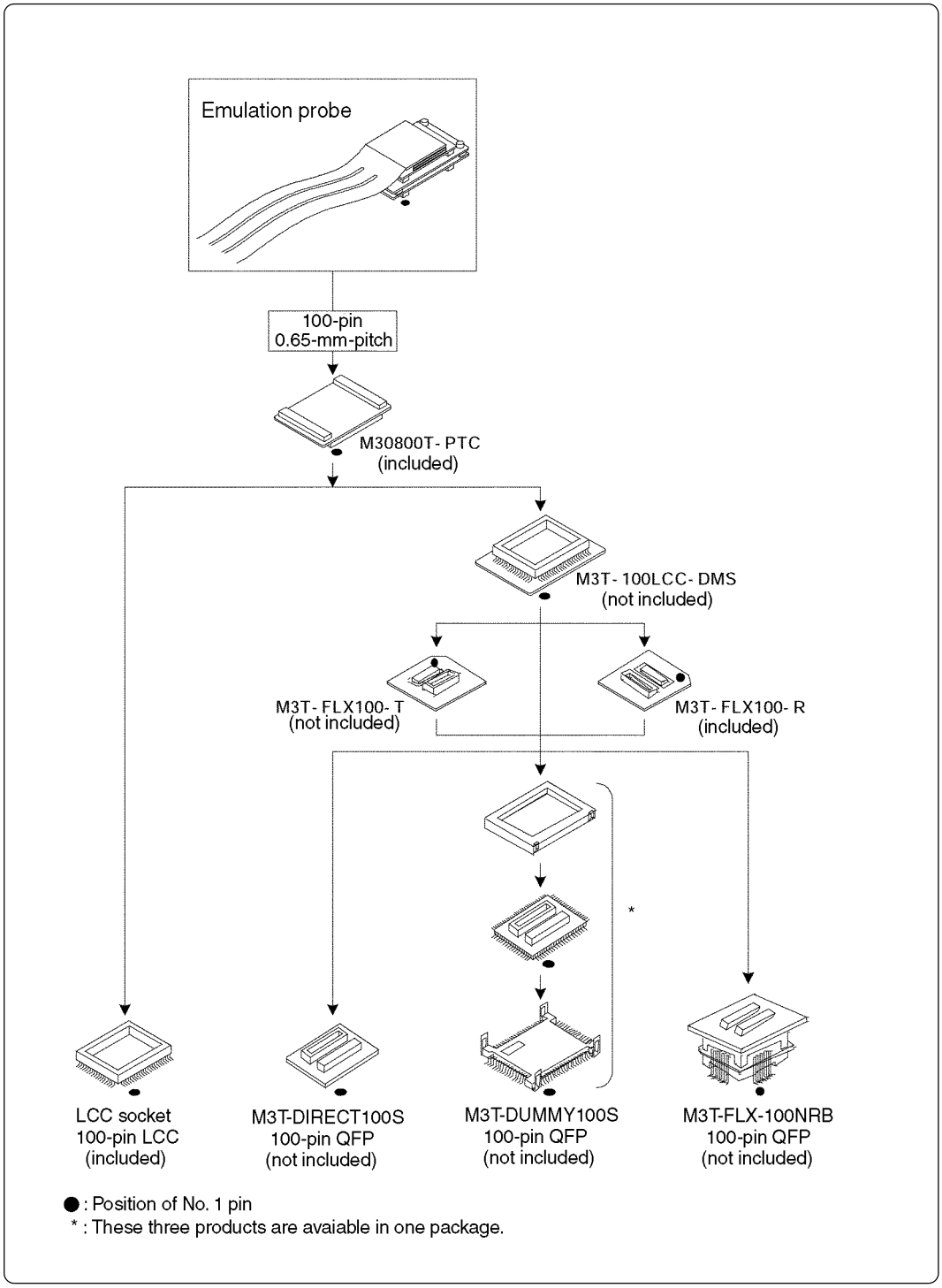


Figure 3.11 Connecting the target system

⚠CAUTION

Note on Connecting the Target System:

- Take care not to attach a converter board in a wrong direction. It may cause a fatal damage to the emulator and targets system.

3.6.1 Connecting to the 100-pin LCC Socket

Here following is a procedure of connecting to the 100-pin LCC socket (IC61-1004-051 of Yamaichi Electronics Co., Ltd.) on the target system using the included M30800T-PTC.

(1) Attach the CN2 side of the M30800T-PTC to the J4 side of the M306N4T-EPB.
(2) Attach the M30800T-PTC to the 100-pin LCC socket.

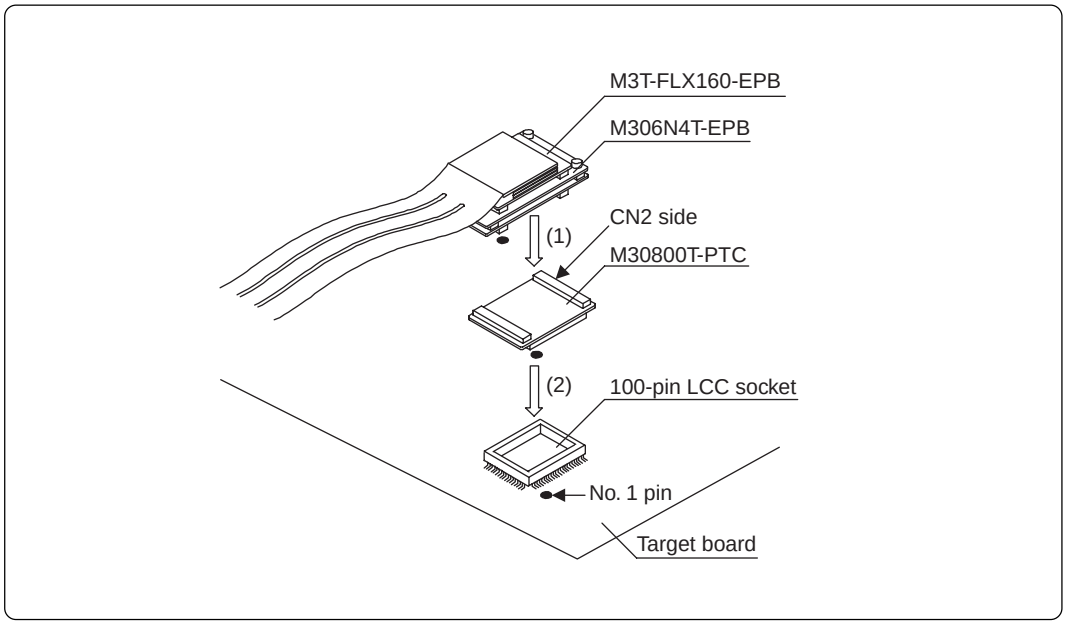


Figure 3.12 Connecting to the 100-pin LCC socket

⚠ CAUTION

Notes on Connecting the Target System:

- Take care not to attach a converter board in a wrong direction. It may cause a fatal damage to the emulator and targets system.
- The connectors of the M30800T-PTC are guaranteed for only 50 insertion/removal iterations.
- For purchasing the IC61-1004-051 or for technical information, contact Yamaichi Electronics Co., Ltd.

  http://www.yamaichi.co.jp/e/index.shtml

3.6.2 Connecting to a 100-pin 0.65-mm-pitch Foot Pattern (Part 1)

Here following is a procedure of connecting to a 100-pin 0.65-mm-pitch foot pattern on the target system using the M3T-DIRECT100S (not included). For details on the M3T-100LCC-DMS (not included) and M3T-DIRECT100S, refer to each instruction manual.

(1) Attach the M3T-DIRECT100S to the target system.
(2) Attach the M3T-100LCC-DMS to the M3T-DIRECT100S.
(3) Attach the CN2 side of the M30800T-PTC to the J4 side of the M306N4T-EPB.
(4) Attach the M30800T-PTC to the M3T-100LCC-DMS.

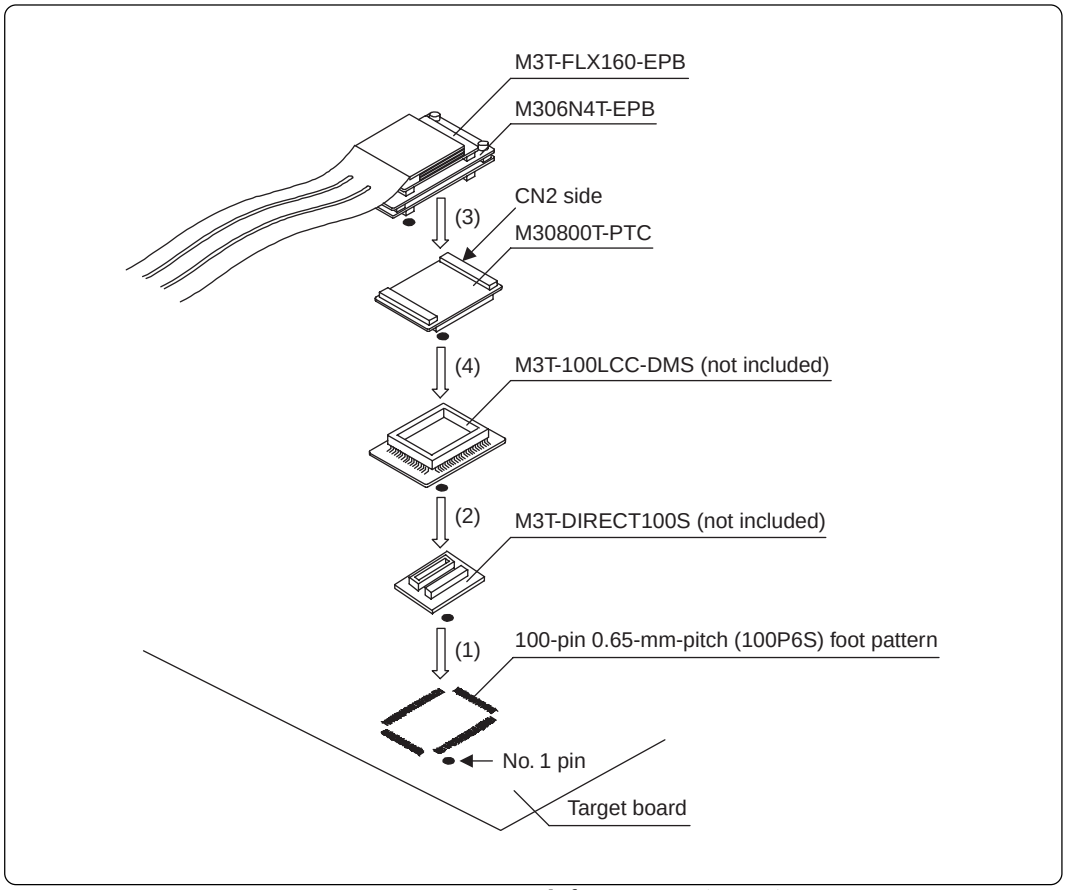


Figure 3.13 Connecting to a 100-pin 0.65-mm-pitch foot pattern (Part 1)

⚠CAUTION

Notes on Connecting the Target System:

- Take care not to attach a converter board in a wrong direction. It may cause a fatal damage to the emulator and targets system.
- The connectors of the M30800T-PTC are guaranteed for only 50 insertion/removal iterations.
- The connectors of the M3T-100LCC-DMS and M3T-DIRECT100S are guaranteed for only 20 insertion/removal iterations.

3.6.3 Connecting to a 100-pin 0.65-mm-pitch Foot Pattern (Part 2)

Here following is a procedure of connecting to a 100-pin 0.65-mm-pitch foot pattern on the target system using the M3T-DUMMY100S (not included). For details on the M3T-100LCC-DMS (not included) and M3T-DUMMY100S, refer to each instruction manual.

(1) Attach the M3T-DUMMY100S to the target system.
(2) Attach the M3T-100LCC-DMS to the M3T-DUMMY100S.
(3) Attach the CN2 side of the M30800T-PTC to the J4 side of the M306N4T-EPB.
(4) Attach the M30800T-PTC to the M3T-100LCC-DMS.

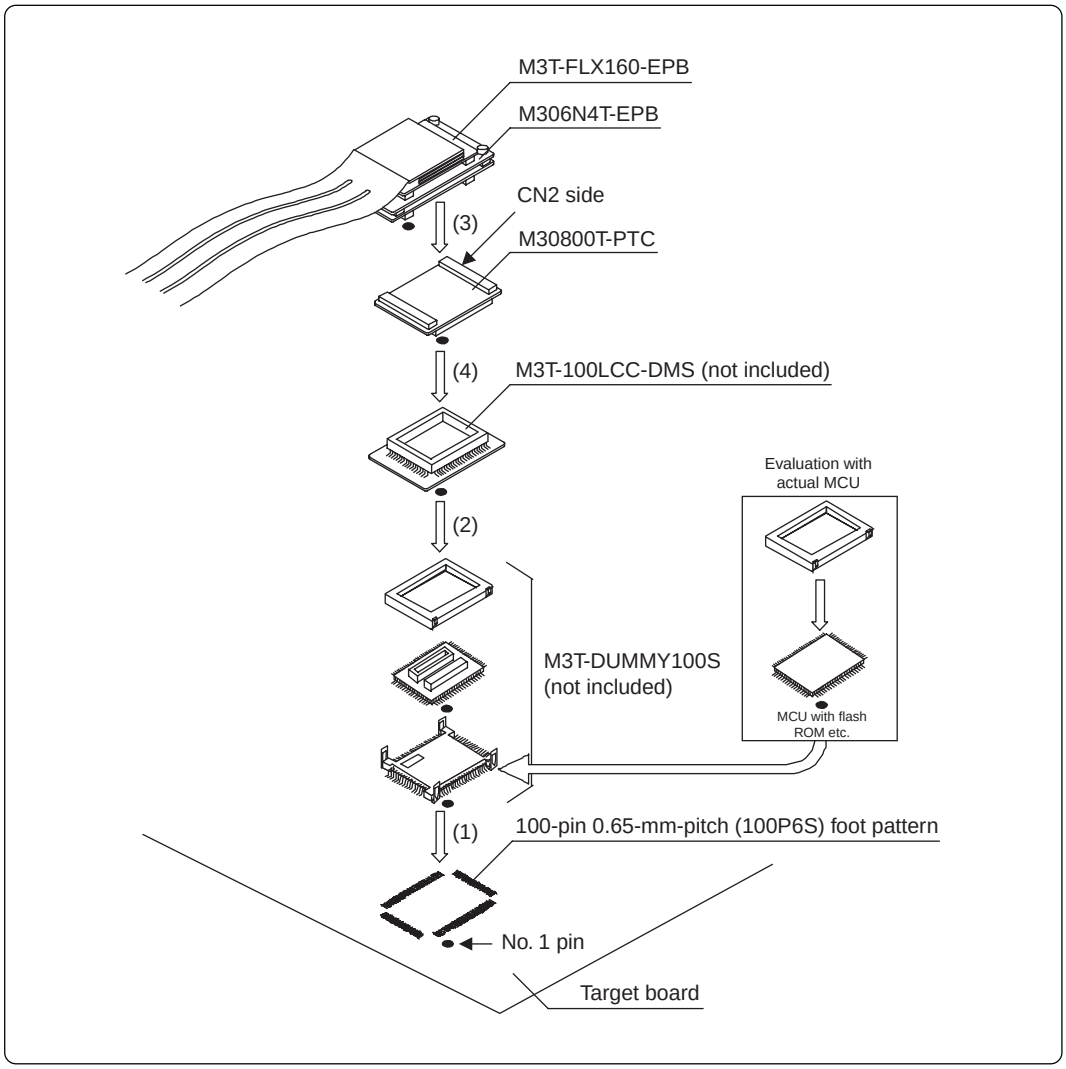


Figure 3.14 Connecting to a 100-pin 0.65-mm-pitch foot pattern (Part 2)

⚠ CAUTION

Notes on Connecting the Target System:

- Take care not to attach a converter board in a wrong direction. It may cause a fatal damage to the emulator and targets system.
- The connectors of the M30800T-PTC are guaranteed for only 50 insertion/removal iterations.
- The connectors of the M3T-100LCC-DMS and M3T-DUMMY100S are guaranteed for only 20 insertion/removal iterations.

3.6.4 Connecting to a 100-pin 0.65-mm-pitch Foot Pattern (Part 3)

Here following is a procedure of connecting to a 100-pin 0.65-mm-pitch foot pattern on the target system using the M3T-FLX-100NRB (not included). For details on the M3T-100LCC-DMS (not included) and M3T-FLX-100NRB, refer to each instruction manual.

(1) Attach the M3T-FLX-100NRB to the target system.
(2) Attach the M3T-100LCC-DMS to the M3T-FLX-100NRB.
(3) Attach the CN2 side of the M30800T-PTC to the J4 side of the M306N4T-EPB.
(4) Attach the M30800T-PTC to the M3T-100LCC-DMS.

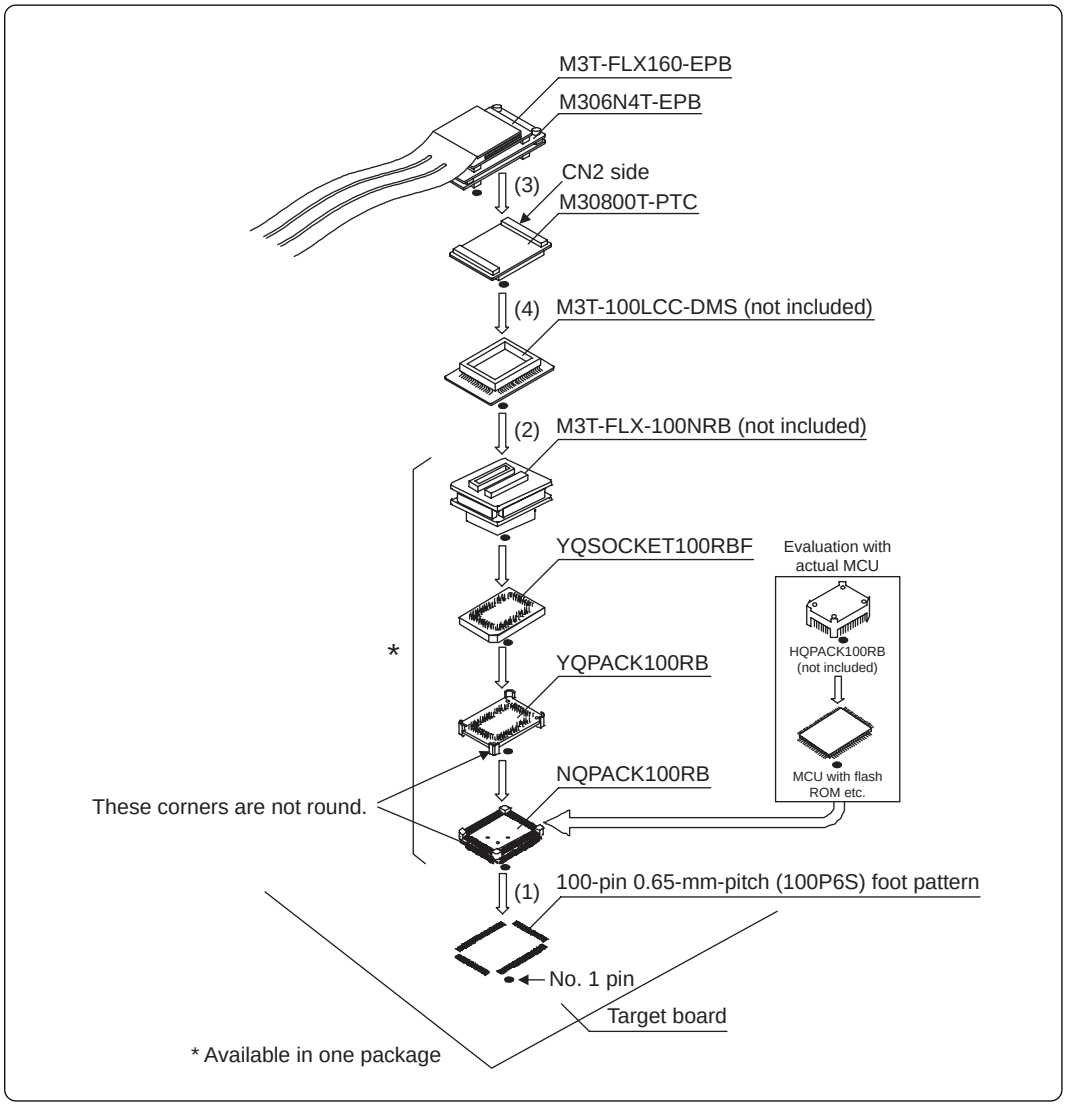


Figure 3.15 Connecting to a 100-pin 0.65-mm-pitch foot pattern (Part 3)

⚠ CAUTION

Notes on Connecting the Target System:

- Take care not to attach a converter board in a wrong direction. It may cause a fatal damage to the emulator and targets system.
- The connectors of the M30800T-PTC are guaranteed for only 50 insertion/removal iterations.
- The connectors of the M3T-100LCC-DMS and M3T-FLX-100NRB are guaranteed for only 20 insertion/removal iterations.

Chapter 4. Usage

This chapter describes from turning on the power of this product to starting up the emulator debugger.

4.1 Turning On the Power 40
4.1.1 Checking Connections of the Emulator System 40
4.1.2 Turning ON/OFF the Power 40
4.1.3 Power Supply to the Target System 40
4.1.4 LED Display When the Emulator Starts Up Normally 41
4.2 Downloading Firmware 42
4.2.1 When It is Necessary to Download Firmware 42
4.2.2 Downloading Firmware in Maintenance Mode 42
4.3 Self-check 43
4.3.1 Self-check Procedure 43
4.3.2 If an Error is Detected in the Self-check 44

Chapter 4. Usage

4.1 Turning On the Power

4.1.1 Checking Connections of the Emulator System

Before turning the power ON, check the connection of the interface cable to the host machine, PC7501, emulation probe, and target system.

4.1.2 Turning ON/OFF the Power

- Turn ON the power of the emulator and target system as simultaneously as possible.
- Turn OFF the power of the emulator and target system as simultaneously as possible.
- Do not leave either the emulator or target system powered on, because of leakage current the internal circuits may be damaged.
- When turning ON the power again after shutting OFF the power, wait for about 10 seconds.

4.1.3 Power Supply to the Target System

- Pin Vcc is connected in order to monitor target system voltage. For this reason, the emulator cannot supply power to the target system. Therefore, provide the target system with a separate power supply.
- The voltage of the target system should be as follows.

  $4.2\ V \leq Vcc \leq 5.5\ V$

4.1.4 LED Display When the Emulator Starts Up Normally

Figure 4.1 shows upper panel LED lighting status when the emulator started up properly. Check it when starting up the emulator system.

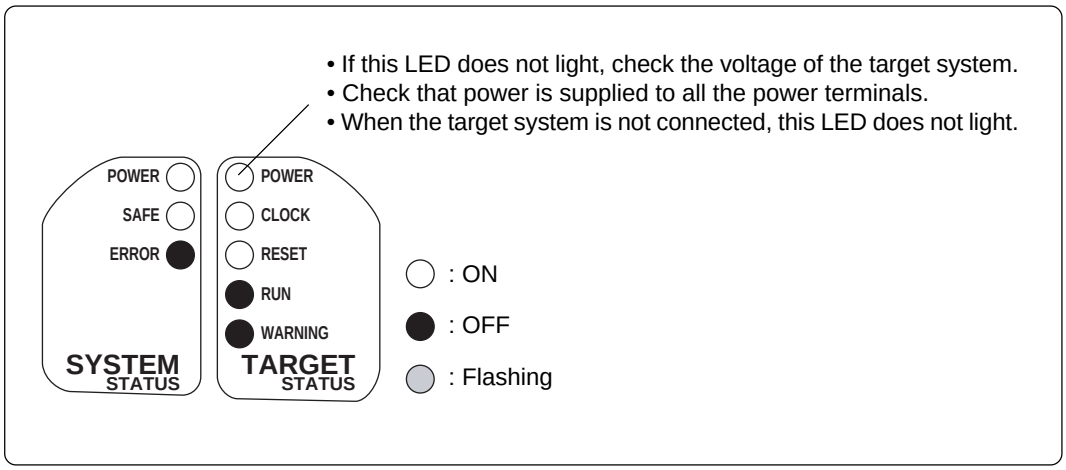


Figure 4.1 LED display of the PC7501 when the power turned on

IMPORTANT

Note on Memory Expansion or Microprocessor Mode:

- To use memory expansion or microprocessor mode, be sure to set pins RDY* and HOLD* so that they are not active at startup. Otherwise the emulator system will not start up correctly.

Note on the Target Status POWER LED:

- If your MCU has two or more Vcc terminals, the LED does not light unless power is supplied to all the terminals.

Note on the Target Status CLOCK LED:

- If the LED is not turned on, check the following.

(1) After powering on the PC7501 (before starting up the emulator debugger):

Make sure that the oscillator circuit board is properly installed in the PC7501 and it is oscillating normally.

(2) After the emulator debugger is started up (after the Init dialog box settings are completed):

Make sure that the oscillator selected in the Init dialog box is oscillating normally.

4.2 Downloading Firmware

4.2.1 When It is Necessary to Download Firmware

It is necessary to download the firmware in the cases listed below. Normally, the following are automatically detected when the emulator debugger is started up, and the firmware is downloaded.

- When you use this product for the first time
- When the emulator debugger or firmware has been upgraded
- When you use this product with a PC7501 which was used with another emulation probe before

When you use this product for the first time or when the power is unexpectedly shut down, redownload the firmware in maintenance mode.

4.2.2 Downloading Firmware in Maintenance Mode

Download firmware in the special mode called maintenance mode as explained here following. Figure 4.2 shows LED displays when downloading firmware.

The target system must not be connected when you download the firmware.

(1) Set the interface select switch on the rear panel of the PC7501 to the LPT side and connect the LPT parallel interface cable to the PC7501 and the host machine.

(2) Within 2 seconds of activating power to the emulator, press the system reset switch on the PC7501 front panel to start maintenance mode. When the emulator is switched to maintenance mode, the System Status SAFE LED begins to flash.

(3) Start up the emulator debugger. When settings in the Init dialog box is complete, the dialog which urges to download the firmware will appear. Download firmware following messages. Required time for downloading the firmware is about 60 seconds.

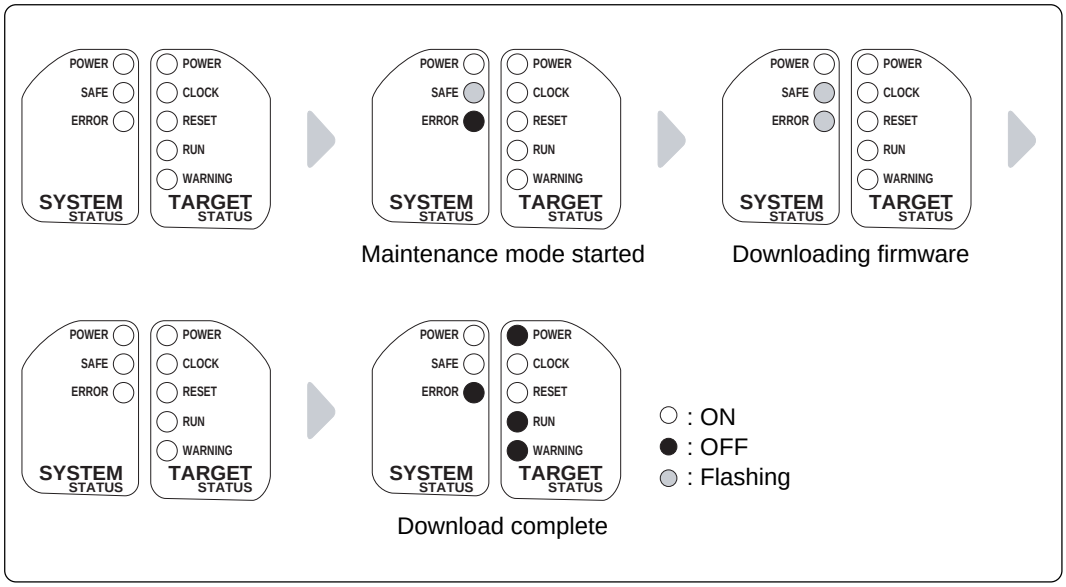


Figure 4.2 LEDs during firmware download

⚠ CAUTION

Note on Downloading Firmware:

- Do not shut OFF power while firmware is being downloaded. Doing so, the emulator will not start up properly. If power is shut off by mistake, redownload the firmware in maintenance mode.

4.3 Self-check

4.3.1 Self-check Procedure

To run the self-check of the emulator, do so as explained here below. While the self-check is in progress, the LEDs will change as shown in Figure 4.3.

(1) If the target system is connected, disconnect it.
(2) Within 2 seconds of activating power to the emulator, press the system reset switch on the emulator front panel to switch the emulator to maintenance mode.
(3) Check the SAFE LED starts flashing and then press the system reset switch again.
(4) The self-check will start. If the normal result is displayed in about 30 seconds, the self-check terminated normally.

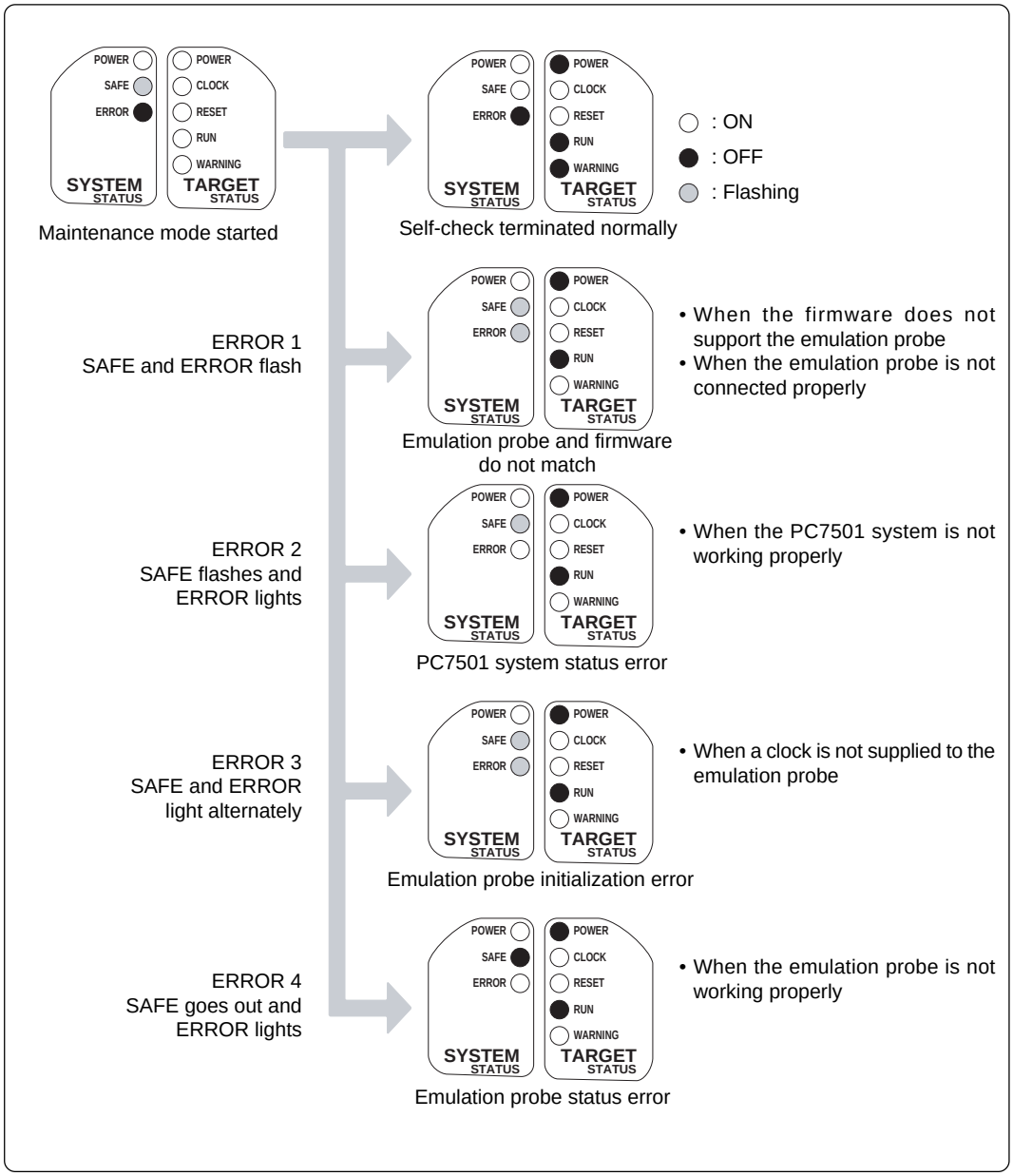


Figure 4.3 LED displays in the self-check

4.3.2 If an Error is Detected in the Self-check

If the self-check does not result normally (ERROR 1 to ERROR 4 in Figure 4.3), check the following.

- Whether the emulation probe and PC7501 are connected properly.
- Whether the proper firmware has been downloaded.

⚠ CAUTION

Note on Self-check:

- If the self-check do not result normally (excluding target system errors), the emulation probe may be damaged. Then contact your local distributor.

Chapter 5. Specifications

This chapter describes specifications of this product.

5.1 Specifications 46
5.2 Operation Timing of Memory Expansion and Microprocessor Modes (5 V) 47
5.3 Connection Diagram 52
5.4 External Dimensions 54
5.4.1 External Dimensions of the Emulation Probe 54
5.4.2 External Dimensions of Converter Board M30800T-PTC 55

5.1 Specifications

Table 5.1 lists the specifications of the M306N4T-EPB.

Table 5.1 Specifications of the M306N4T-EPB

Emulator	PC7501
Applicable MCU	M16C/6N Group M16C/6N4, M16C/6N Group M16C/6N5
Evaluation MCU	M30627FHPGP, M306N4FGTKP (Custom package for emulator) ROM: 384 KB + 4 KB, RAM: 31 KB
Usable MCU mode	Single-chip mode Memory expansion mode (NORMAL) Microprocessor mode (NORMAL)
Emulation memory	(1) Internal ROM of MCU: 384 KB + 4 KB (0F000h--0FFFFh, A0000h--FFFFFh, maximum operating frequency: 20 MHz, 0 wait) (2) Internal RAM of MCU: 31 KB (00400h--07FFFh, maximum operating frequency: 20 MHz, 0 wait) (3) CS3*--CS0* area (Possible to allocate by 4 KB, maximum operating frequency: 10 MHz, 0 wait)
Maximum operating frequency	20 MHz (Operating voltage: 4.2 to 5.5 V) (When using PLL)
Clock oscillator	Xin-Xout (1 to 16 MHz): Switchable to internal oscillator circuit board, external oscillator input or internal generator circuit Xcin-Xcout (32.768 kHz): Switchable to internal oscillator circuit board or external oscillator input
Operating frequency	4.2 to 5.5 V
Operating temperature	5 to 35°C (no dew)
Storage temperature	-10 to 60°C (no dew)
Power supply to emulator	Supplied from DC power supply of the emulator main unit
Connection to target system (see 3.6 "Connecting the Target System" on page 34)	**For 100-pin LCC socket:** M30800T-PTC (included) + IC61-1004-051 (included) **For 100-pin 0.65-mm-pitch QFP (100P6S-A):** (1) M30800T-PTC (included) + M3T-100LCC-DMS (not included) + M3T-DIRECT100S (not included) (2) M30800T-PTC (included) + M3T-100LCC-DMS (not included) + M3T-DUMMY100S (not included) (3) M30800T-PTC (included) + M3T-100LCC-DMS (not included) + M3T-FLX-100NRB (not included)

5.2 Operation Timing of Memory Expansion and Microprocessor Modes (5 V)

(1) Separate Bus Timing

Table 5.2 and Figure 5.1 show the bus timing in memory expansion and microprocessor modes (3-wait, accessing external area).

Table 5.2 Memory expansion and microprocessor modes (3-wait, accessing external area)

Symbol	Item	Actual MCU [ns]		This product [ns]	
		Min.	Max.	Min.	Max.
td(BCLK-AD)	Address output delay time		25		See left
th(BCLK-AD)	Address output hold time (BCLK standard)	4		See left	
th(RD-AD)	Address output hold time (RD standard)	0		See left	
th(WR-AD)	Address output hold time (WR standard)	(*2)		See left	
td(BCLK-CS)	Chip-select output delay time		25		See left
th(BCLK-CS)	Chip-select output hold time (BCLK standard)	4		See left	
td(BCLK-ALE)	ALE signal output delay time		25		See left
th(BCLK-ALE)	ALE signal output hold time	-4		See left	
td(BCLK-RD)	RD signal output delay time		25		See left
th(BCLK-RD)	RD signal output hold time	0		See left	
td(BCLK-WR)	WR signal output delay time		25		See left
th(BCLK-WR)	WR signal output hold time	0		See left	
td(BCLK-DB)	Data output delay time (BCLK standard)		40		See left
th(BCLK-DB)	Data output hold time (BCLK standard)	4		See left	
td(DB-WR)	Data output delay time (WR standard)	(*1)		See left	
th(WR-DB)	Data output hold time (WR standard)	(*2)		See left	

*1 Calculated by the following formula according to the frequency of BCLK.

$$\frac{(n - 0.5)\times 10^9}{f(BCLK)} \text{ -40 [ns]} \qquad \text{n: "3" for 3-wait}$$

*2 Calculated by the following formula according to the frequency of BCLK.

$$\frac{0.5\times 10^9}{f(BCLK)} \text{ [ns]}$$

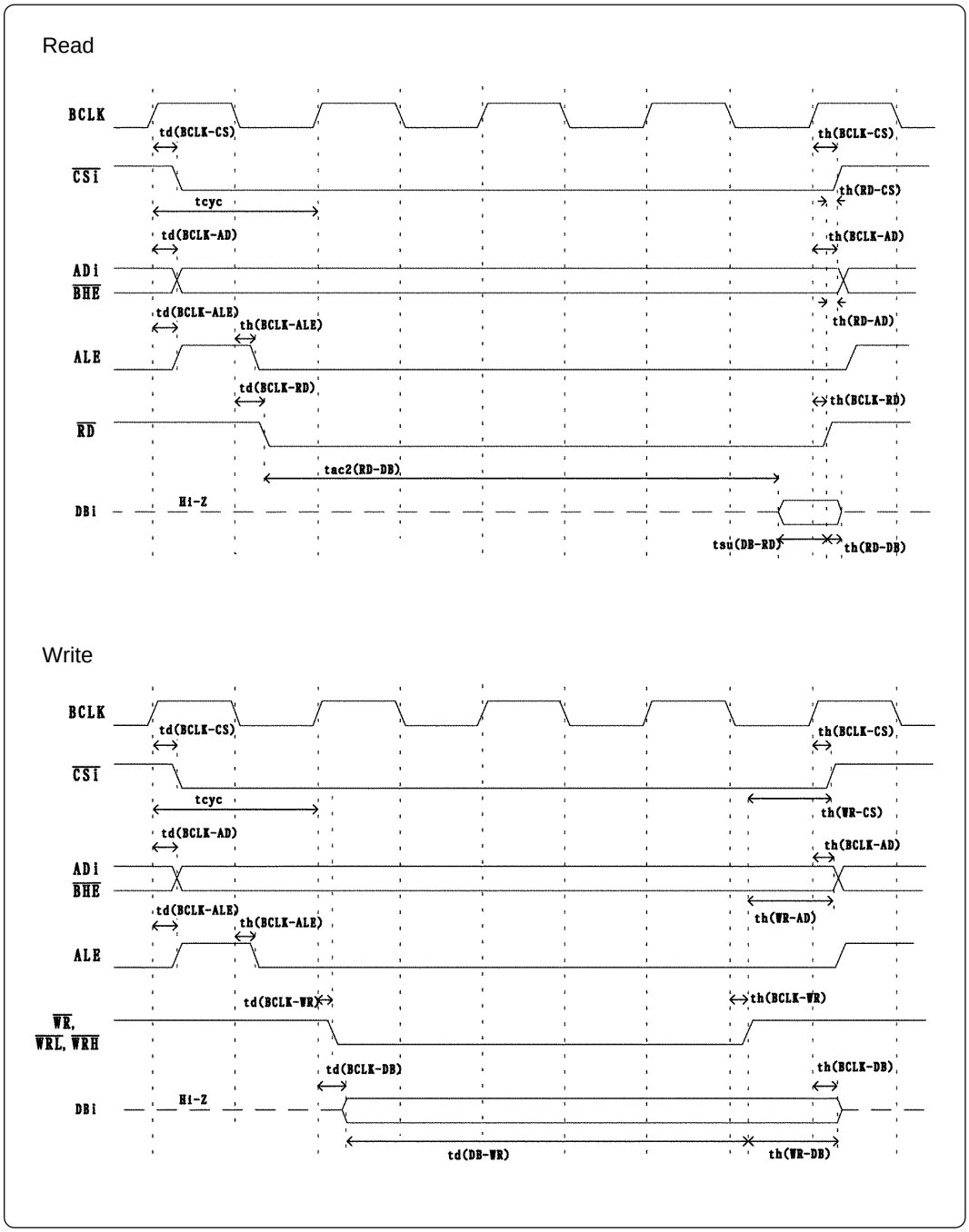


Figure 5.1 Memory expansion and microprocessor modes (3-wait, accessing external area)

(2) Multiplex Bus Timing

Table 5.3 and Figure 5.2 show the bus timing in memory expansion and microprocessor modes (2-wait, accessing external area, using multiplex bus).

Table 5.3 Memory expansion and microprocessor modes (2-wait, accessing external area, using multiplex bus)

Symbol	Item	Actual MCU [ns]		This product [ns]	
		Min.	Max.	Min.	Max.
td(BCLK-AD)	Address output delay time		25		See left
th(BCLK-AD)	Address output hold time (BCLK standard)	4		See left	
th(RD-AD)	Address output hold time (RD standard)	(*1)		See left	
th(WR-AD)	Address output hold time (WR standard)	(*1)		See left	
td(BCLK-CS)	Chip-select output delay time		25		See left
th(BCLK-CS)	Chip-select output hold time (BCLK standard)	4		See left	
th(RD-CS)	Chip-select output hold time (RD standard)	(*1)		See left	
th(WR-CS)	Chip-select output hold time (WR standard)	(*1)		See left	
td(BCLK-RD)	RD signal output delay time		25		See left
th(BCLK-RD)	RD signal output hold time	0		See left	
td(BCLK-WR)	WR signal output delay time		25		See left
th(BCLK-WR)	WR signal output hold time	0		See left	
td(BCLK-DB)	Data output delay time (BCLK standard)		40		See left
th(BCLK-DB)	Data output hold time (BCLK standard)	4		See left	
td(DB-WR)	Data output delay time (WR standard)	(*2)		See left	
th(WR-DB)	Data output hold time (WR standard)	(*1)		See left	
td(BCLK-ALE)	ALE output delay time (BCLK standard)		25		See left
th(BCLK-ALE)	ALE output hold time (BCLK standard)	-4		See left	
td(AD-ALE)	ALE output delay time (Address standard)	(*3)		See left	
th(ALE-AD)	ALE output hold time (Address standard)	30		See left	
td(AD-RD)	After address RD signal output delay time	0		See left	
td(AD-WR)	After address WR signal output delay time	0		See left	
tdz(RD-AD)	Address output floating start time		8		See left

*1 Calculated by the following formula according to the frequency of BCLK.

$$\frac{0.5 \times 10^9}{f(BCLK)} \text{ [ns]}$$

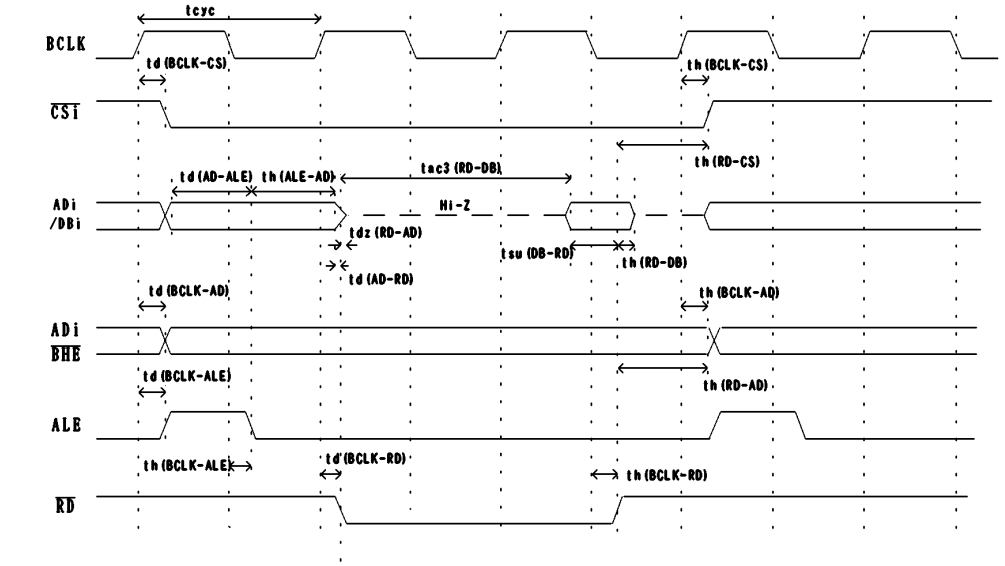
*2 Calculated by the following formula according to the frequency of BCLK.

$$\frac{(n - 0.5) \times 10^9}{f(BCLK)} - 40 \text{ [ns]}$$ n: "2" for 2-wait

*3 Calculated by the following formula according to the frequency of BCLK.

$$\frac{0.5 \times 10^9}{f(BCLK)} - 25 \text{ [ns]}$$

Read



Write

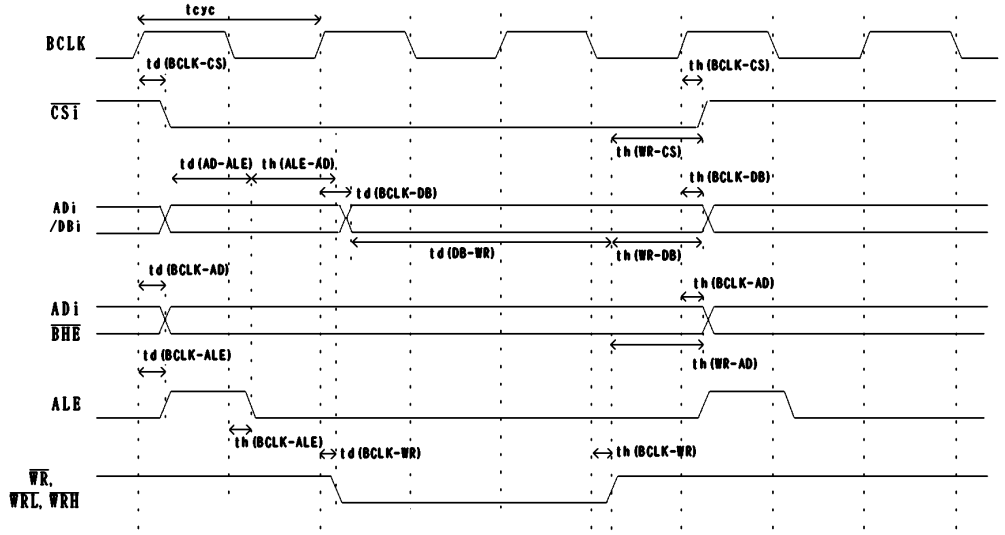


Figure 5.2 Memory expansion and microprocessor modes (2-wait, accessing external area, using multiplex bus)

(3) Timing Requirements

Tables 5.4 and Figure 5.3 list the timing requirements in memory expansion and microprocessor modes.

Table 5.4 Timing requirements

Symbol	Item	Actual MCU [ns]		This product [ns]	
		Min.	Max.	Min.	Max.
tsu(DB-RD)	Data input setup time	40		55	
tsu(RDY-BCLK)	RDY* input setup time	30		45	
tsu(HOLD-BCLK)	HOLD* input setup time	40		55	
th(RD-DB)	Data input hold time	0		See left	
th(BCLK-RDY)	RDY* input hold time	0		See left	
th(BCLK-HOLD)	HOLD* input hold time	0		See left	
td(BCLK-HLDA)	HLDA* output delay time		40		See left

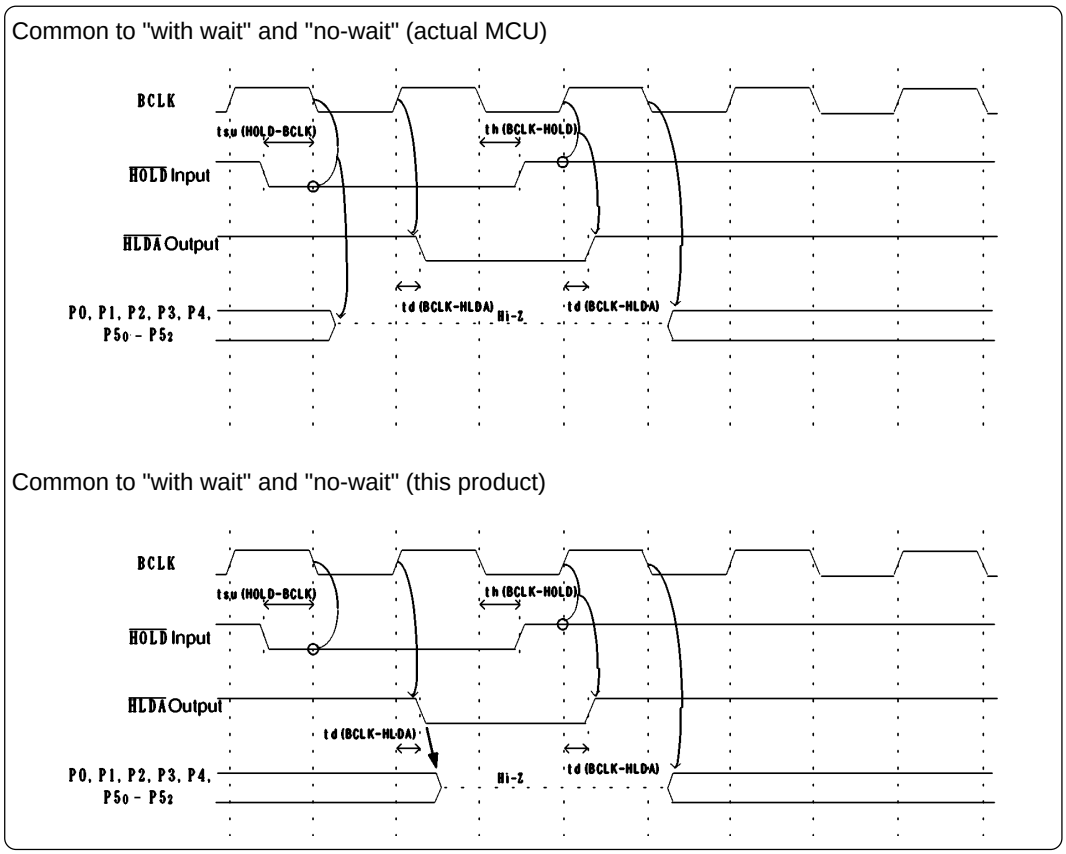


Figure 5.3 Timing requirements

* Compared with the actual MCU, this product enters high-impedance state after a 0.5 cycle delay.

5.3 Connection Diagram

Figures 5.4 shows a connection diagram of the M306N4T-EPB. This connection diagram mainly shows the interface section. The circuits not connected to the target system such as the emulator's control system are omitted. The signals not shown in Figure 5.4 connect the evaluation MCU and the target system directly.

Tables 5.5 and 5.6 show IC electric characteristics of this product for reference purposes.

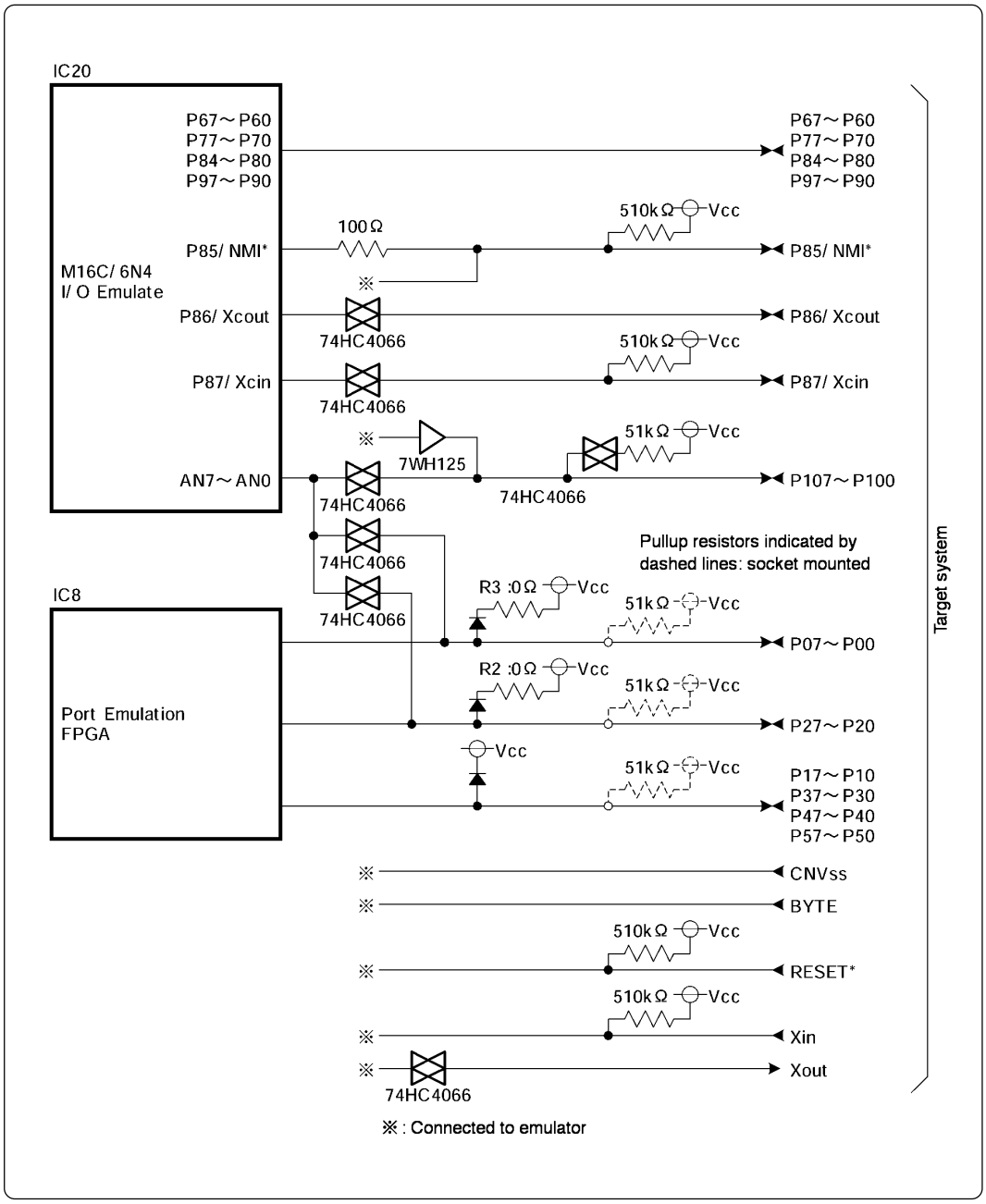


Figure 5.4 Connection diagram

Table 5.5 Electrical characteristics of the 74HC4066

Symbol	Item	Condition	Standard values			Unit
			Min.	Standard	Max.	
R_{ON}	ON resistor	Vcc = 4.5 V	-	96	200	Ω
△ R_{ON}	ON resistor difference	Vcc = 4.5 V	-	10	-	
I_{OFF}	Leak current (Off)	Vcc = 12.0 V	-	-	±1	μA
I_{IZ}	Leak current (On, output: open)	Vcc = 12.0 V	-	-	±1	

Table 5.6 Electrical characteristics of the port emulation FPGA

Symbol	Item	Condition	Standard values			Unit
			Min.	Standard	Max.	
V_{IH}	"H" level input voltage		2.0	-	5.5	V
V_{IL}	"L" level input voltage		-0.5	-	0.8	
V_{OH}	"H" level output voltage	I_{OH} = -8 mA DC, Vcc = 4.75 V	2.4	-	-	
		I_{OH} = -8 mA DC, Vcc = 3.00 V	2.4	-	-	
V_{OL}	"L" level output voltage	I_{OL} = 8 mA DC, Vcc = 4.75 V	-	-	0.45	
		I_{OL} = 8 mA DC, Vcc = 3.00 V	-	-	0.45	
I_{OZ}	Leak current (Tristate)	Vo = Vcc or GND	-40	-	40	μA
C_{IN}	I/O pin input capacitance	V_{IN} = 0 V, f = 1.0 MHz	-	-	8	pF

5.4 External Dimensions

5.4.1 External Dimensions of the Emulation Probe

Figure 5.5 shows external dimensions of the M306N4T-EPB and M30800T-PTC.

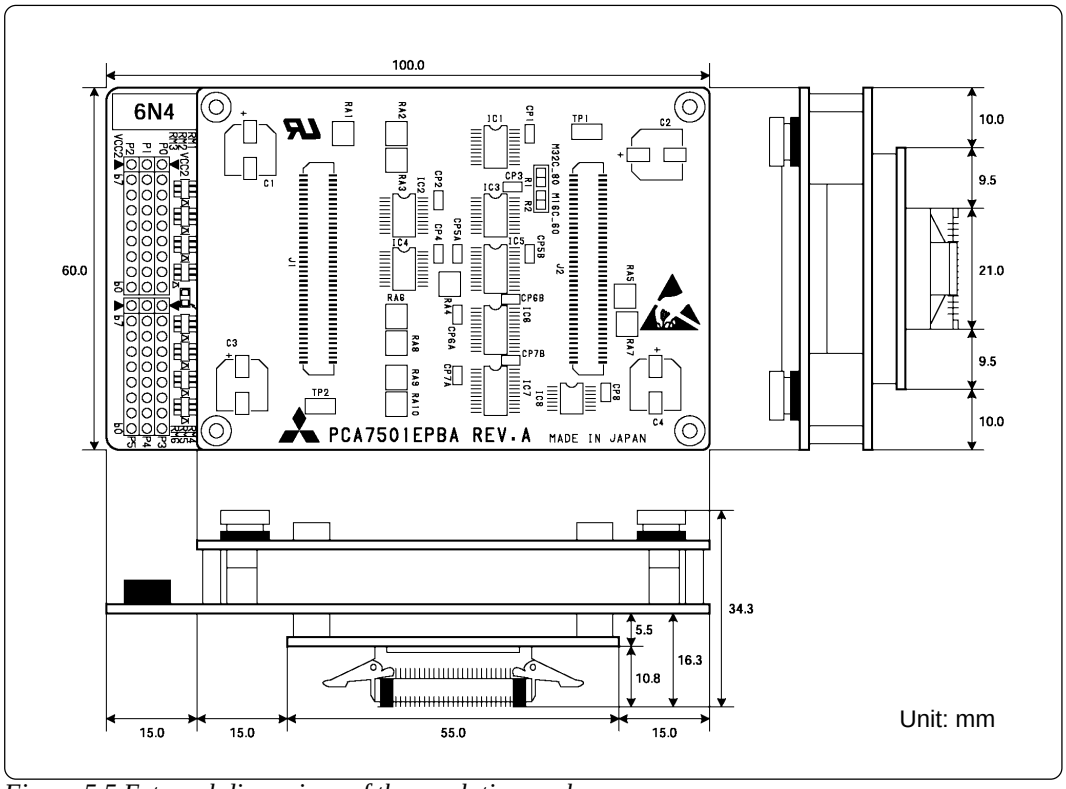


Figure 5.5 External dimensions of the emulation probe

5.4.2 External Dimensions of Converter Board M30800T-PTC

Figure 5.6 shows external dimensions of converter board M30800T-PTC (included) for a 100-pin LCC.

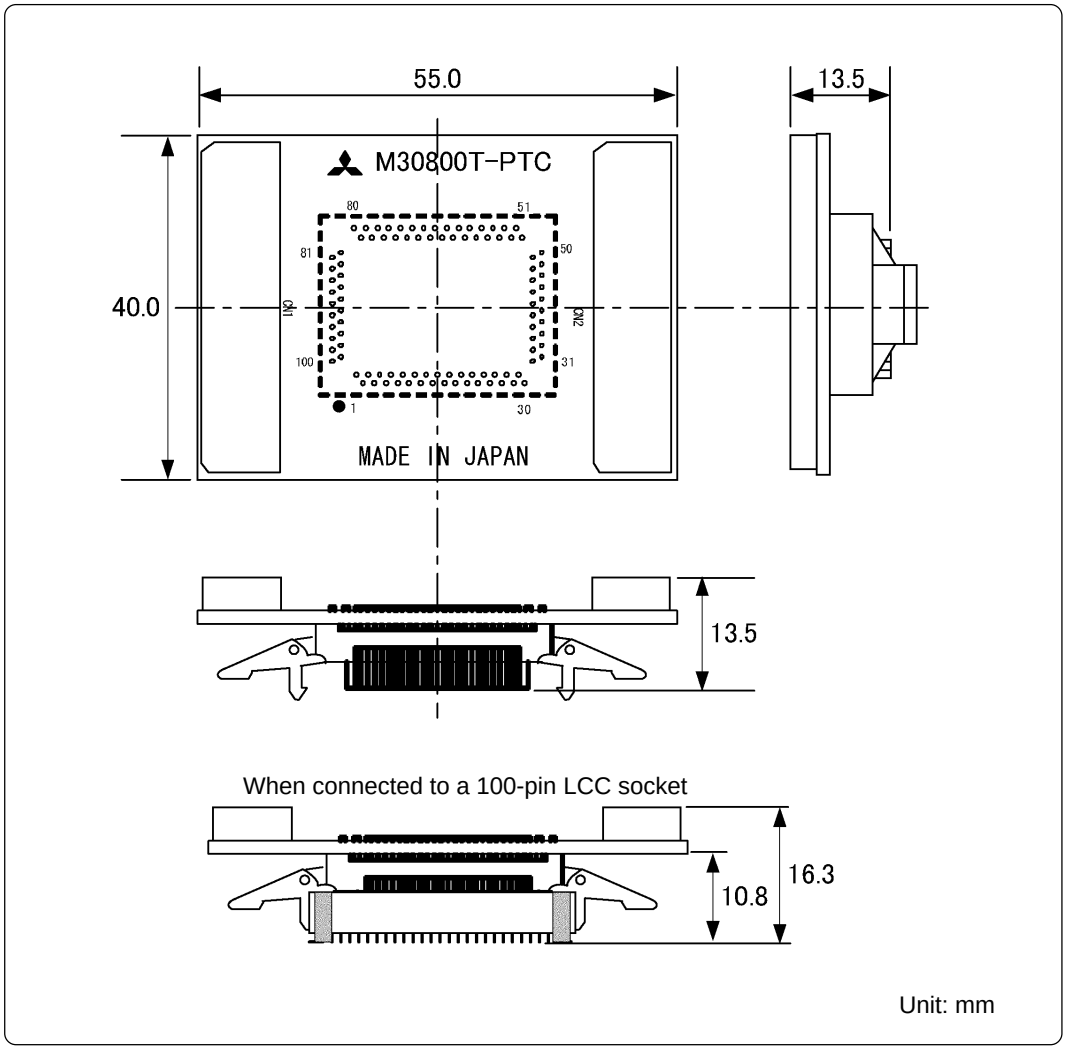


Figure 5.6 External dimensions of converter board M30800T-PTC

MEMO

Chapter 6. Troubleshooting

This chapter describes how to troubleshoot when this product does not work properly.

6.1 Flowchart to Remedy the Troubles 58
6.2 When the Emulator Debugger Does Not Start Up Properly 59

Chapter 6. Troubleshooting

6.1 Flowchart to Remedy the Troubles

Figure 6.1 shows the flowchart to remedy the troubles from when power to the emulator is activated until the emulator debugger starts up. Check this while the target system is disconnected. For the latest FAQs visit the Mitsubishi Tool Homepage.

http://www.tool-spt.maec.co.jp/index_e.htm

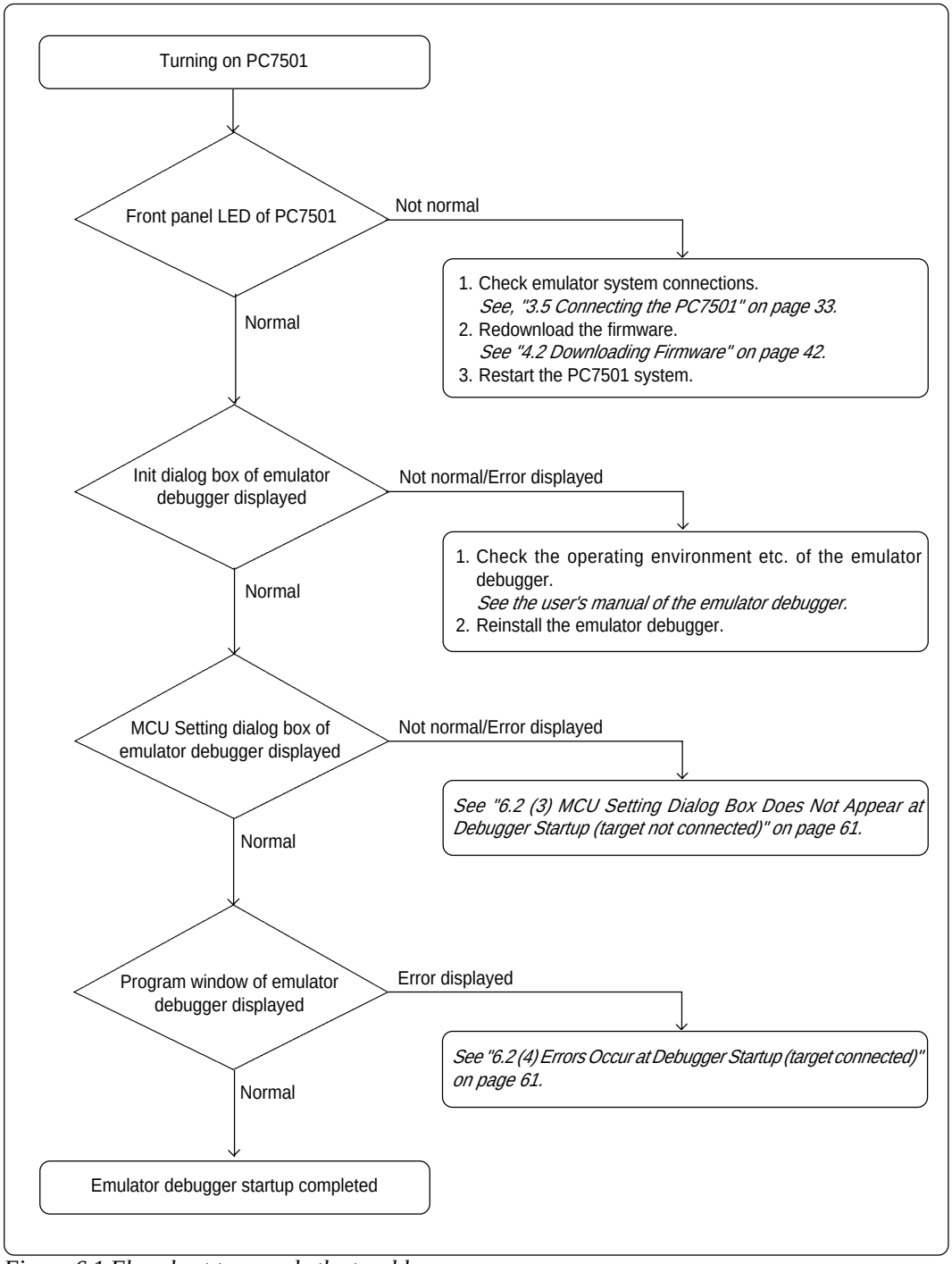

Turning on PC7501
Front panel LED of PC7501
Not normal
1. Check emulator system connections.
See, "3.5 Connecting the PC7501" on page 33.
2. Redownload the firmware.
See "4.2 Downloading Firmware" on page 42.
3. Restart the PC7501 system.
Normal
Init dialog box of emulator debugger displayed
Not normal/Error displayed
1. Check the operating environment etc. of the emulator debugger.
See the user's manual of the emulator debugger.
2. Reinstall the emulator debugger.
Normal
MCU Setting dialog box of emulator debugger displayed
Not normal/Error displayed
See "6.2 (3) MCU Setting Dialog Box Does Not Appear at Debugger Startup (target not connected)" on page 61.
Normal
Program window of emulator debugger displayed
Error displayed
See "6.2 (4) Errors Occur at Debugger Startup (target connected)" on page 61.
Normal
Emulator debugger startup completed

Figure 6.1 Flowchart to remedy the troubles

6.2 When the Emulator Debugger Does Not Start Up Properly

(1) When the LEDs of the PC7501 Shows an Error

Table 6.1 Errors LEDs show and their checkpoints

Error	Connection to the target system	Checkpoint
LEDs do not light up.	-	Check that the power cable is connected to the PC7501. *See the user's manual of the PC7501.*
All LEDs remain lit.	-	Check the connection between the PC7501 and this product. *See "3.5 Connecting the PC7501" on page 33.*
Target Status POWER LED does not light up.	Connected	Check that power is properly supplied to the target system and that the target system is properly grounded.
Target Status CLOCK LED does not light up.	Not connected	(1) Check that both the main and sub clocks of the emulator debugger are not set to "EXT". *See the CLK command of the emulator debugger.* (2) Check that the oscillator circuit board is properly installed in the emulator and is oscillating. *See "3.1 Selecting Clock Supply" on page 26.*
	Connected	Check that the oscillator circuit in the target system is oscillating properly.
Target Status RESET LED does not go out.	Connected	Check that the reset pin of the target system is pulled up.

(2) MCU Setting Dialog Box Does Not Appear at Debugger Startup (target connected)

Table 6.2 Checkpoints of errors at debugger startup (target connected)

Error	Checkpoint
Communication error occurred. Data was not sent to the target.	Check that all emulator debugger settings, interface cable settings and switches on the rear of the PC7501 match. *See the user's manuals of the PC7501 and emulator debugger.*
Target system cannot be properly built.	(1) Download the proper firmware. *See "4.2 Downloading Firmware" on page 42.* (2) Check the connection between the PC7501 and this product. *See "3.5 Connecting the PC7501" on page 33.*
M3T-PD30F version is not the same version as the firmware in the target.	Download the proper firmware. *See "4.2 Downloading Firmware" on page 42.*
Target MCU is in the reset state.	(1) Check that the reset pin of the target system is pulled up. (2) Check that the reset pin of the target system has changed from Low to High level.
Target MCU cannot be reset.	(1) Check that pin NMI* is held High. (2) If in memory expansion or microprocessor mode, check that pins RDY* and HOLD* are held High. (3) If the reset circuit of the target system has a watchdog timer, disable the timer. (4) Check that power is properly supplied to the target system and that the target system is properly grounded.
Target is in "HOLD" state.	The MCU is either in stop mode or wait mode. Either reset the MCU or cancel the mode with an interrupt. *See MCU specifications.*
Target clock is stopped.	Check that the oscillator circuit of the target system is oscillating properly.
Target MCU is not receiving power.	Check that power is properly supplied to the target system and that the target system is properly grounded.

(3) MCU Setting Dialog Box Does Not Appear at Debugger Startup (target not connected)

Table 6.3 Checkpoints of errors at debugger startup (target not connected)

Error	Checkpoint
Communication error occurred. Data was not sent to the target.	Check that all emulator debugger settings, interface cable settings and switches on the rear of the PC7501 match. *See the user's manuals of the PC7501 and emulator debugger.*
Target system cannot be properly built.	(1) Download the proper firmware. *See "4.2 Downloading Firmware" on page 42.* (2) Recheck the connection between the PC7501 and this product. *See "3.5 Connecting the PC7501" on page 33.*
M3T-PD30F version is not the same version as the firmware in the target.	Download the proper firmware. *See "4.2 Downloading Firmware" on page 42.*
Target is in HOLD state.	The MCU is either in stop mode or wait mode. Either reset the MCU or cancel the mode with an interrupt. *See MCU specifications.*

(4) Errors Occur at Debugger Startup (target connected)

Table 6.4 Checkpoints of errors at debugger startup (target connected)

Error	Checkpoint
Target MCU is uncontrollable.	(1) Check that pin NMI* is held High. (2) If in memory expansion or microprocessor mode, check that pins RDY* and HOLD* are held High.

MEMO

Chapter 7. Maintenance and Guarantee

This chapter describes how to maintenance, repair provisions and how to request for repair.

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Chapter 7. Maintenance and Guarantee

7.1 Maintenance

If dust or dirt collects on any equipment of your emulation system, wipe it off with a dry soft cloth. Do not use thinner or other solvents because these chemicals can cause the equipment's surface coating to separate.

7.2 Guarantee

The emulation probe presented here has passed Mitsubishi's product inspection. If your emulation probe becomes faulty within 12 months after purchase while being used under good conditions by observing the Precautions for Safety described in "Chapter 1. Precautions for Safety", Mitsubishi will repair the fault free-of-charge. (This provision does not apply to emulation probes leased to you.) When repair is required, contact your nearest of Mitsubishi office or its distributor.

7.3 Repair Provisions

If a fault in your equipment falls under one of the following categories, the fault will be corrected by replacing the entire equipment instead of repairing, depending on the severity of fault:

- Faulty or broken mechanical section
- Flaw, separation, or rust in coated or plated section
- Flaw or crack in plastic section
- Fault or breakage caused by incorrect use or unauthorized repair or modification
- Heavily damaged electric circuits due to shorting of power supply, overvoltage, or overcurrent
- Crack in printed circuit board or burned-down patterns
- Broad range of fault making replacement less expensive than repairing
- Unlocatable or unidentifiable fault

7.4 How to Request for Repair

If your M306N4T-EPB is found faulty, follow the procedure below to send your product for repair.

Customer

Write down the necessary information in the "M306N4T-EPB Repair Request Sheet" attached hereto, then send it along with the M306N4T-EPB for repair to your local distributor or nearest office of Mitsubishi Electric.

Make sure that information in the M306N4T-EPB Repair Request Sheet is written in as much detail as possible to facilitate repair.

Distributor

After checking the contents of fault, the distributor should please send the faulty M306N4T-EPB along with the Repair Request Sheet to Mitsubishi Electric.

Mitsubishi Electric Semiconductor Application Engineering Corporation

When the faulty M306N4T-EPB is repaired, it will be returned to the customer at the earliest convenience.

⚠ CAUTION

Note on Transporting the Product:

- When sending your M306N4T-EPB for repair, use the packing box and cushion material supplied with the M306N4T-EPB when delivered to you and specify handling caution for it to be handled as precision equipment. If packing of your product is not complete, it may be damaged during transportation. When you pack your product in a bag, make sure to use conductive polyvinyl supplied with the M306N4T-EPB (usually a blue bag). When you use other bags, they may cause a trouble on your product because of static electricity.